

SUMMER 1999

Harvard Medical

ALUMNI BULLETIN



Music & Medicine

Since trading his scalpel for a baton, Samuel Wong has been using music to heal



LANDMARK

1932

Harvey Cushing
performs surgery
before the Cushing
Society at the
Peter Bent Brigham
Hospital in Boston.

CONTENTS



DEPARTMENTS

Letters.....	3
Pulse.....	4
Match Day, a new department chair	
President's Report.....	10
by George E. Thibault	
Bookshelf.....	11
Benchmarks.....	12
How "McLose Place" and G.I. Joe can affect young people's self-images.	
Alumna Profile.....	64
Mercedes von Deck, an orthopedic surgeon, waltzes and tangos during her hours away from the O.R.	
Class Notes.....	66
In Memoriam.....	71
John Edwin Adams	
Obituaries.....	72

SPECIAL REPORT: MUSIC AND MEDICINE

Musical Healing..... 14

A physician-turned-orchestra conductor returns to the wards, this time bearing song.

by SAMUEL WONG

Cerebral Symphony..... 20

How do the miniature orchestras in our brains translate music?

by DEBRA MALINA

Tuning Up Musicians..... 28

Harvard doctors treat the injuries of musical performers.

by PHYLLIS L. FAGILL

Health Through Song..... 36

Outreach workers in Benin and Guatemala use lyrics to promote health.

by MATTHEW DAVIS

Medical Maestros..... 42

HMS alumni compose lives that balance music and medicine.

by BEVERLY BALLARO & DEBRA MALINA

Smooth Operator..... 46

From Beethoven to Barenaked Ladies, a survey of the musical preferences of alumni in the O.R.

FEATURES

Light Sleepers..... 50

Harvard researchers investigate insomnia on the Final Frontier.

by DEBRA MALINA

Mission to Mars..... 56

Preparation for a flight to Mars may aid those ailing on Earth.

by DEBRA MALINA

Magical Stones and Imperial Bones..... 58

Countway Library's treasures range from x-rays of the czar's and czarina's hands to Thomas Jefferson's ruminations on vaccines.

by JACK ECKERT



Cover photograph by Gary Hofheimer



In this Issue

The "Mozart effect" is popping up all over these days. Indeed, several Mozart effects seem to be appearing in the media.

For more than five years now, some psychologists have asked their subjects to listen to Mozart's Sonata for Two Pianos in D Major (K. 448) before attempting certain mental tasks. Much of this research has suggested that visuospatial abilities are briefly enhanced after as little as ten minutes of exposure to the music, and these results have been highly publicized. (Apparently no one has yet assessed whether K. 504, or something by Haydn or Bach, let alone the Sex Pistols, would do as well.)

As we go to press, however, controversy about the "Mozart effect" has spilled from the pages of *Nature* into the newspapers. Christopher Chabris, a research fellow at Massachusetts General Hospital, has weighed the published studies of this Mozart effect and found them wanting. On the whole, according to Chabris, the mental advantage seems to be at best negligible, hardly strong enough to warrant supplying new mothers with compact discs of classical music, as is currently the policy in Georgia, South Dakota, and Tennessee. Perhaps these states could divert the money they are spending on CDs to music education—an intervention with some potential to make a real difference in the mental development of schoolchildren.

Meanwhile, other government bodies have identified quite a different effect of classical music. Public officials in both Canada and the United States have demonstrated that playing such works as *Eine kleine Nachtmusik* and *Nessun dorma* in public spaces is astonishingly effective at clearing an area of adolescent loiterers, who are made as uncomfortable by classical music as their elders are by gangsta rap.

The most dismal Mozart effect, to me, has been the decision by a local classical music station to play Wolfgang and rather little else, so that the commercial jingles have become a kind of relief from K. 1 to K. 626 used as sonic wallpaper. Perhaps the best that can be said for the psychological experiments with K. 448 is that the music was played for only ten minutes.

In this issue we take a little more than ten minutes to look at the manifold and delightful connections between music (not only Mozart) and medicine.

On a nonmusical note, this issue is the first to be designed in our new format. We hope you like it.

William Ira Bennett

EDITOR-IN-CHIEF
William Ira Bennett '68

EDITOR
Paula Brewer Byron

ASSOCIATE EDITOR
Phyllis L. Fagell

ASSISTANT EDITOR
Beverly Ballaro, PhD

BOOK REVIEW EDITOR
Elissa Ely '88

EDITORIAL BOARD
Elissa Ely '88

Robert M. Goldwyn '56

Joshua Hauser '93

Paula A. Johnson '84

Perri Klass '86

Victoria McEvoy '75

James J. O'Connell '82

Gabriel Otterman '91

Deborah Prothrow-Stith '79

Guillermo C. Sanchez '49

J. Gordon Scannell '40

Joshua Sharfstein '96

Eleanor Shore '55

John D. Stoeckle '47

DESIGN DIRECTOR
Laura McFadden

ASSOCIATION OFFICERS

George E. Thibault '69, president
Sharon B. Murphy '69, president-elect 1
Charles J. Hatem '66, president-elect 2
Stephen G. Pauker '68, vice president
David D. Oakes '68, secretary
James B. Field '51, treasurer

COUNCILLORS

Claire V. Broome '75
Paul Farmer '90
B. Lachlan Forrow '83
David P. Gilmour '66
Laurie R. Green '76
Gerald T. Keusch '62
Michael A. LaCombe '68
Alison G. May '91
Deborah J. Oyer '87
Morton N. Swartz '47

DIRECTOR OF ALUMNI RELATIONS
Daniel D. Federman '53

ASSISTANT DEAN FOR ALUMNI
AFFAIRS AND SPECIAL PROJECTS
Nora N. Nercessian, PhD

REPRESENTATIVE TO THE
HARVARD ALUMNI ASSOCIATION
Chester d'Autremont '44

The *Harvard Medical Alumni Bulletin* is published quarterly at 25 Shattuck Street, Boston, MA 02115 © by the Harvard Medical Alumni Association.
Phone: (617) 432-1548 • Fax: (617) 432-0013
Email: bulletin@hms.harvard.edu
Third class postage paid at Boston, Massachusetts. Postmaster, send form 3579 to 25 Shattuck Street, Boston, MA 02115
ISSN 0191-7757 • Printed in the U.S.A.

Remembering Mentors

I very much appreciate your including me in the Winter 1999 *Bulletin*. The issue looked terrific.

It was particularly poignant for me to be included in an issue with memorial articles on Steve Robinson and Dick Nesson. Steve was my mentor through medical school and the early part of my housestaff and fellowships training, and Dick had been one of my mentors for the last decade. I was very close to both of them and remain close to their families. Without their guidance and mentorship I doubt very much that I would have enjoyed what ever success I have.

LAWRENCE N. SHULMAN '75
BOSTON, MASSACHUSETTS

Communicating in Other Languages

After reading about the series of multilingual phrase books in the spring

issue of the *Bulletin*, I was prompted to share an anecdote from my as-yet-unpublished memoir, *By All Means, Resuscitate*.

I began my third year at HMS in the autumn of 1946. There I was, on the wards at Massachusetts General Hospital during those heady virgin moments of a clinical clerkship. I soon recognized the linguistic discomfort of a multitude of first generation American patients.

Coming from a home where English was the primary language, I had experienced the feeling of alienation when my parents switched to Yiddish or Romanian. At Massachusetts General Hospital, I was ashamed to have to admit to an elderly Jewish lady that, "No, I do not speak Yiddish, except, 'Take care and you'll live a long life.'" These few words in Yiddish brought a warm smile and immediate bonding that I recognized went beyond confirmation that I was a fellow Jew.

I thereupon embarked on an effort to learn the key words of history taking in all the languages represented on my ward, and there were many—Yiddish, Chinese, Greek, Italian, and Russian. I made a lexicon of the basic 25 words and phrases I would need, including: hello, how are you, please, thank you, how old are you, where does it hurt, urine, and stool.

Early during the probing to fill in my wordlist, I sat between the beds of two old-fashioned, doctor-revering Italian men and asked them, "Tell me, please, how do you ask an old, refined Italian lady if she has seen blood in her stool?" Laughing hysterically while whispering each possible word to one another, they finally confessed that neither of them knew an acceptable word for stool. I assume that when my conversation with the Italian lady occurred, I ended up playing charades.

In time I learned that the few words I knew were generally inadequate and paled immeasurably beside the services of an interpreter. But saying *spasibo* ("thank you" in Russian), *min fovase* ("don't be afraid" in Greek), and *vu tut es vay* ("where does it hurt?" in Yiddish) to the appropriate patient brought a smile, a look of approval, and an appreciation of my respect for their origins.

I commend Daniel Federman and Nora Nercessian for publishing the multilingual phrase books and for recognizing that the logistical aspect of improved communication also allows doctors to reap immeasurable humanistic rewards.

DAVID L. CHAMOVITZ '48
TEL AVIV, ISRAEL



The Bulletin welcomes letters to the editor. Please send letters by mail (Harvard Medical Alumni Bulletin, 25 Shattuck Street, Boston, Massachusetts 02115); fax (617-432-0013); or email (bulletin@hms.harvard.edu). Letters may be edited for length or clarity.

A Match Made in Cyberspace

THE NATIONAL RESIDENT MATCHING PROGRAM introduced two significant changes to the matching process this year. Match applicants learned from the World Wide Web whether they successfully matched to a residency training position, and those who did not initially match were given 48 hours rather than 24 to obtain a residency position before Match Day.

Despite the new electronic format, HMS, like most U.S. medical schools, continued with its traditional Match Day ceremony. As usual, about half the HMS class will join Harvard-affiliated hospitals for their residencies. The most popular specialty choices were internal medicine (35 percent), pediatrics (13 percent), general surgery (8 percent), and emergency medicine (6 percent). On the other end of the spectrum, neurology, pathology, and radiation oncology claimed only one student apiece. Eleven students chose to defer their residencies to pursue other opportunities ranging from a book contract to a Rhodes scholarship.



PHOTO: LIZA GREEN

ANESTHESIA

MARK BOMANN

University of California,
San Francisco

MARK LOVICH

Massachusetts General Hospital

DERMATOLOGY

ALEKSANDR ITKIN

Boston University
Medical Center

PAMELA KIRSCHNER

Barnes-Jewish Hospital,
St. Louis

BRIAN STREAMS

Massachusetts General Hospital

EMERGENCY MEDICINE

RABIATU ABDULLAH

Alameda County Medical
Center, Oakland, CA

KULLENI GEBREYES

Johns Hopkins Hospital

STEPHEN KAHN

Vanderbilt University
Medical Center

TAMARA KELLOGG

Einstein/Jacobi, Bronx

HELEN KUO

Cook County Hospital, Chicago

CRAIG NORQUIST

Maricopa Medical Center,
Phoenix

STEPHEN SCHENKEL

University of Michigan Hospitals

JARED STROTE

Stanford University Programs

TODD THOMSEN

Brigham and Women's Hospital

FAMILY PRACTICE

SUSANNA CHOU

Scripps Memorial Hospital,
La Jolla, CA

MAISHA DRAVES

University of California,
San Francisco

SARAH-ANNE SCHUMANN

Boston University Medical
Center

REBECCA SMALL

Sutter Medical Center,
Santa Rosa, CA

GENERAL SURGERY

TODD BRENNAN

University of California,
San Francisco

WING CHEUNG

Massachusetts General Hospital

DAVID COOKE

Massachusetts General Hospital

REUBEN GOBEZIE

Brigham and Women's Hospital

KENZO HIROSE

University of California,
San Francisco

MICHAEL HOUSE

Johns Hopkins Hospital



JULES LIN

University of Michigan Hospitals

UDAYA LIYANAGE

Barnes-Jewish Hospital,
St. Louis

REBECCA MARIER

Madigan Army Medical
Center, Tacoma, WA

SUBROTO PAUL

Brigham and Women's Hospital

KRISTINE REESER

Mayo Graduate School of
Medicine, Scottsdale, AZ

JEANNE YU

New York Presbyterian
Hospital (Cornell campus)

INTERNAL MEDICINE

JODIE BABITT

Beth Israel Deaconess
Medical Center

MITALI BAPNA

University of Chicago Hospital

DAN BAROUCH

Massachusetts General Hospital

PAUL BAUM

Stanford University Programs

JAMES BECKERMAN

Massachusetts General Hospital

PAVELJIT BINDRA

Massachusetts General Hospital

SARAH BLAKE

University of Washington
Affiliated Hospitals

CAROLINE BROWN

Massachusetts General Hospital

JULIE CARTER

Massachusetts General Hospital

DIMITRI CASSIMATIS

National Capital Consortium,
Washington, DC

JIM CHEUNG

Massachusetts General Hospital

NATALIA COLOCCI

Stanford University Programs

CYNTHIA COOPER

Massachusetts General Hospital

LORI DANIELS

University of California,
San Diego Medical Center

LAUREN DIAS

Massachusetts General Hospital

BENJAMIN EBERT

Massachusetts General Hospital

CHARLES FOX

Massachusetts General Hospital

JENNIFER FURIN

Brigham and Women's Hospital

LEVI GARRAWAY

Massachusetts General Hospital

CRAIG GUNDERSON

Yale-New Haven Hospital

KURT HONG

Scripps Clinic/Green Hospital,
La Jolla, CA

HANNA IRIE

Massachusetts General Hospital

DOUGLAS JACOBY

Hospital of the University
of Pennsylvania, Philadelphia

AHMAD KAMAL

Stanford University Programs

JIMMY KO

Beth Israel Deaconess
Medical Center

DEREK KUNIMOTO

Massachusetts General Hospital

MARILYN KUO

New York Presbyterian
Hospital (Columbia campus)

JENNIFER LEE

Stanford University Programs

ALIZA LEVINE

Georgetown University
Hospital

NANCY LIN

Brigham and Women's Hospital

DOUGLAS LOWE

Medical College of
Georgia, Augusta

ANNE LUETKEMEYER

University of California,
San Francisco

MARK OSTERMAN

Brigham and Women's Hospital

VIKAS PAREKH

University of Michigan Hospitals

TODD PULERWITZ

Johns Hopkins Hospital

CHRISTOPHER REID

William Beaumont Army
Medical Center, El Paso, TX

JENNIFER REILLY

University of Michigan Hospitals

EVE RITTENBERG

Brigham and Women's Hospital

LAUREN RUBENSTEIN

Massachusetts General Hospital

KELLI SATTERWHITE

Hospital of St. Raphael
Program, New Haven, CT

BENJAMIN SCIRICA

Brigham and Women's Hospital

THOMAS SEQUIST

Brigham and Women's Hospital

BRADLEY SHARPE

University of California,
San Francisco

C. REBECCA SUK

Massachusetts General Hospital

EMILY SWANSON

Massachusetts General Hospital

DOAN-TRANG TRAN

UCLA Medical Center

DANUTA TRZEBINSKA

Massachusetts General Hospital

ALICE TSANG

Massachusetts General Hospital

LECIA VAN DAM

Brigham and Women's Hospital

MABEL VASQUEZ

University of Southern
California, Los Angeles

TATIANA VOCI

University of Massachusetts
Programs, Worcester

ALLISON WALSH

Massachusetts General Hospital

EMILY WINSLOW

Boston University Medical
Center

KAI XIA

Brigham and Women's Hospital



SCOTT YANG

University of Washington
Affiliated Hospitals, Seattle

KAYLA ZOMLEFER

Massachusetts General Hospital

MEDICINE/PEDIATRICS

MAREN BATALDEN

Harvard Combined
Medicine/Pediatrics

DANIEL CALAC

University of Southern
California, Los Angeles

KRISTIN ITO

Duke University Medical
Center, Durham, NC

DAVID MARK

Harvard Combined
Medicine/Pediatrics

NEUROLOGY

JASON ROSENBERG

Johns Hopkins University

NEUROSURGERY

DANIEL DILORENZO

University of Utah,
Salt Lake City

JOHN O'TOOLE, JR.

Columbia University

**ALFREDO QUINONES-
HINOJOSA**

University of California,
San Francisco

PATRICK SENATUS

Columbia University

KRISTEN UPCHURCH

Georgetown University

OB/GYN

ANN BRYANT

Brigham and Women's Hospital

SARA HUGHES

Brigham and Women's Hospital

LARRY RAND

Brigham and Women's Hospital

MATTHEW REEVES

University of California,
San Francisco

ANNE SU

University of California,
San Francisco

OPHTHALMOLOGY

TSONTCHO IANCHULEV

University of Southern
California, Los Angeles

MING LU

Massachusetts Eye and
Ear Infirmary

JAY STEWART

University of California,
San Francisco

JENNIFER SUN

Massachusetts Eye and
Ear Infirmary

ORAL SURGERY

BRETT DENHART

Massachusetts General Hospital

RICHARD TANNYHILL III

Massachusetts General Hospital

ORTHOPEDIC SURGERY

ANDREW BEHARRIE

Hospital of the University of
Pennsylvania, Philadelphia

RENN CRICLOW

Harvard Combined
Orthopedics Program

AMBER DUNCAN

University of Massachusetts
Programs, Worcester

ALEXIS FALICOV

University of Washington
Affiliated Hospitals, Seattle

MOE LIM

Hospital for Special Surgery,
New York City

STANLEY NYARKO

University Hospitals
of Cleveland

ROBERT O'TOOLE

Harvard Combined
Orthopedics Program

RACHEL ROHDE

University Health
Center of Pittsburgh

OTOLARYNGOLOGY

ANH NGUYEN-HUYNH

Harvard Medical School

**KONSTANTINA
STANKOVIC**

Harvard Medical School

PATHOLOGY

SIYAVASH KURDISTANI

UCIA Medical Center

PEDIATRICS

SUSANA ACEVEDO

Children's Hospital,
Oakland, CA

KIMBERLY AVILA

Baylor College of
Medicine, Houston

LIZA AYUSO

Jackson Memorial
Hospital, Miami

ELISSA BLUM

Boston Combined Pediatric
Residency

KRISTEN BRESLIN

Boston Combined Pediatric
Residency

JEANETTE CALLAHAN

Massachusetts General Hospital

AIMEE CROW

Children's Memorial
Hospital, Chicago

RENUKA EDPUGANTI

Johns Hopkins Hospital

SARAH GELEHRTER

University of Michigan Hospitals

GUIDO GUIDOTTI

Massachusetts General Hospital

JOAN HAN

Boston Combined Pediatric
Residency

DEBORAH JAMES

Rhode Island Hospital/Brown
University

KAREN LEVINE

Boston Combined Pediatric
Residency

RACHEL LEWIS

New York Presbyterian
Hospital (Columbia campus)

REBECA MALAMUD

Boston Combined Pediatric
Residency





ELLIOT MELENDEZ

Boston Combined Pediatric
Residency

OUZAMA NICHOLSON

Massachusetts General Hospital

**JACQUELINE OWUSU-
ANTWI**

Boston Combined Pediatric
Residency

**MEENAKSHI
RAMAKRISHNAN**

University of Washington
Affiliated Hospitals, Seattle

LEONARDO TRASANDE

Boston Combined Pediatric
Residency

PLASTIC SURGERY

ANDREW CHEN

Barnes-Jewish Hospital,
St. Louis

KIMBERLY LU

University of Washington
Affiliated Hospitals, Seattle

PSYCHIATRY

GEORGE ALLEN, JR.

Cambridge Hospital

DIANA GRAHAM

New York University
Medical Center

SUE LEE

University of California,
San Francisco

ROBIN MAY

Neuropsychiatric Institute,
University of California,
Los Angeles

SARITA NORI

Massachusetts General Hospital

JOANNA STEINGLASS

New York Presbyterian
Hospital (Columbia campus)

GIRISH SUBRAMANYAN

University of California,
San Francisco

SHENG-SHIH NANCY WU

University of California,
San Francisco

RADIATION ONCOLOGY

PRAJNAN DAS

Joint Center for Radiation
Therapy, Boston

RADIOLOGY

PETER GLICKMAN

Massachusetts General Hospital

DONNELLA GREEN

Brigham and Women's Hospital

ALEXANDER GUIMARAES

Massachusetts General Hospital

RACHEL HITT

Massachusetts General Hospital

ANDREW KAPUSTIN

Hospital of the University of
Pennsylvania, Philadelphia

LUIS MAAS III

University of California
San Francisco

AARON SODICKSON

Brigham and Women's Hospital

UROLOGY

EDUARDO CANTO

Baylor College of
Medicine, Houston

JEAN OU

Harvard Medical School

LILIANA WOO

University of Texas Medical
School, Houston

OTHER

ALEXA ALBERT

Book Contract, Random
House, New York City

TED ASHBURN

Strategic Management,
Pfizer, Inc., Groton, CT

SANGEETA BHATIA

Assistant Professor and
Director of the Department
of Bioengineering/Microscale
Tissue Engineering Lab,
University of California,
San Diego

BRIAN BRAMSON

Director, Health Frontiers'
Child Health Training Project,
Vientiane, Laos

CHRISTOPHER CHEN

Assistant Professor of Biomed-
ical Engineering and Cell and
Developmental Biology, Johns
Hopkins Medical School

JENNIFER DEVOE
Rhodes Scholar, London

OR GOZANI
Postdoctoral Fellow in
Neurobiology, HMS

VIJAY IYENGAR
Associate Consultant,
McKinsey & Co., Boston

PANKAJ MERCHIA
Associate McKinsey
& Co., Florham Park, NJ

JAMES MORRIS
Harvard Junior Fellow,
Harvard University

BERNARDO SABATINI
Postdoctoral Fellow, Cold
Springs Harbor Laboratory
Cold Springs Harbor, NY

New Neurobiology Chair



In June, Deon Joseph Martin announced the return of Corlo Sholtz to the Harvard community.

Sholtz did her graduate and postdoctoral work in the HMS Department of Neurobiology; upon her return to HMS later this year, she will become the department's new chair. Currently, she is the Class of 1943 Professor of Neurobiology at the University of California, Berkeley; a Howard Hughes Medical Institute investigator; and an adjunct professor of physiology at the University of California, San Francisco. Before taking the Berkeley position in 1992, Sholtz was a professor of neurobiology at Stanford.

In his announcement, Martin called Sholtz "one of the world's leading developmental neurobiologists."

Sholtz's research focuses on the mechanisms of the neuronal connections made during development that result in the precise and orderly wiring of the adult central nervous system. Her work in defining activity-dependent synapse formation is widely known, said Martin.

Sholtz serves on the national advisory council of the National Institute of Neurological Disorders and Stroke, the council of the National Academy of Sciences, and the board of directors of the McKnight Endowment Fund for Neuroscience.

"Her lab will immediately add synergy to some of the strengths of our current department as she seeks opportunities to build new areas of cutting-edge science within the department and in collaboration with other units, on and off the Quod," Martin said. ■

PARIS LEFT BANK

We offer rental of our spacious, well-appointed 17th century apartment home. The period decor includes all modern conveniences. The location is the finest in Paris, on the Rue de Varenne, 7th Arrondissement. Maid service and our *Guide to the Best of Paris* are included for free.

ST. BART'S CARIBBEAN

We offer rental of our wonderful home on the ideal tropical island. Our spacious property has a private pool and is carefully-tended, perfect for honeymoons and relaxing vacations. Maid service and our *Guide to the Best of St. Barts* are included free of charge.

(650) 327-2415

Please call for further particulars.
It will be a pleasure to assist you.

ADVERTISE HERE

The *Harvard Medical
Alumni Bulletin*
invites you to place an
ad in these pages.

Call

617-432-1548

The Schott Letter

*The nation's most unique
investment letter written & edited by
John Schott, M.D. HMS '66*

**"The highly regarded Schott
Letter helps investors cope
with emotional hang-ups
that make for mistakes in
the stock market."**

Forbes, Feb. 1996

In 1986 Dr. Schott
recommended the purchase
of Berkshire Hathaway;
will you be a reader
when he finds the next
Berkshire Hathaway?

24% average returns for 12 years

The Schott Letter
120 Centre Street
Dover, MA 02050

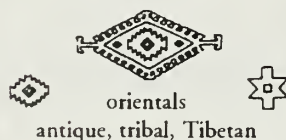
\$110.00 for 12 issues
MC/VISA

1 (800) 797-9678

decor international

141 newbury st., boston
(617) 262-1529

Vegetable dyed folk rugs
depicting Turkish village life.



handwoven rugs

orientals • village rugs • Polish
Romanian • Tunisian • Navajo
American hand-hooked
• tapestries • folk art
Free Validated Parking

President's Report

THE FIRST SESSION OF OUR winter meeting was canceled because of a blizzard; the first session of our spring meeting was marked by record heat for June 8, with temperatures reaching 98 degrees. A testimonial to the wonders of New England weather.

To launch the spring meeting, Council members met with the class agents at the Harvard Club. Daniel Federman, dean for medical education, led a discussion about what HMS might do to mark the year 2000. Excellent ideas were offered, including: celebrating the contributions of HMS graduates, predicting how medicine will change in the twenty-first century, and easing student debt.

The next day's meeting opened with a review of the residency match results for members of the Class of 1999, most of whom received their first or second choice. Their choices reflected a continued upward trend in the number of Harvard students selecting a primary care discipline. Nine students will not pursue clinical work directly, representing a slight increase from past years.

The Council next discussed clinical education, beginning with the challenges facing teaching hospitals in meeting their educational missions. We spelled out the financial pressures on the teaching hospitals as the result of declining third-party payor reimbursements and the impact of the Balanced Budget Act.

Council members then turned to the decline in the teaching of clinical skills nationwide. Ideas proposed to improve the situation at HMS included: recruiting retired physicians to supplement current faculty, developing an HMS society that would promote clinical skills, using more rigorous competency exams,

and securing funds to free up faculty time to concentrate on teaching.

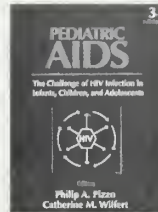
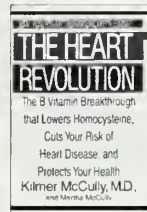
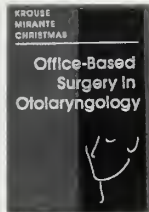
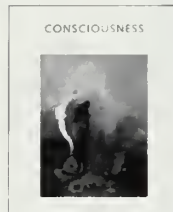
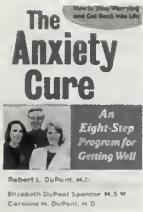
Dean Joseph Martin joined the group, speaking optimistically about the state of the School and the opportunities before us. He then introduced HMS initiatives for improving the student experience. He noted that the recent fundraising drive has been extraordinarily successful in raising money to improve Quadrangle facilities; more funds will be raised to support student financial aid.

Dean Martin also announced that he has received university approval to increase the payout for the 100 endowed chairs by 1 percent for each of the next five years. This increase will represent an infusion of \$20 million into the clinical departments at the hospitals. The dean is determined to see that these resources be used to support educational activities and to help alleviate the financial pressures on the hospitals.

The dean then brought up the issues of millennium activities and alumni outreach, a discussion that occupied the rest of the meeting. Many ideas were proposed, including conducting an alumni survey, holding regional meetings, and planning alumni week activities in 2000 and 2001.

This is my last report to you as Council president. I am indebted to Dan Federman, Nora Necessian, and the extraordinarily talented and dedicated Council members with whom I have been privileged to serve. I look forward to continuing to work with my friend and classmate Sharon Murphy, the new president, and Charlie Hatem, the president elect, in making plans for increasing alumni involvement in our year 2000 celebrations. ■

George E. Thibault '69 is vice president of clinical affairs at Partners HealthCare Systems, Inc. in Boston.



The Anxiety Cure

An Eight-Step Program for Getting Well, by Robert L. DuPont '62, Elizabeth DuPont Spencer, and Caroline M. DuPont (John Wiley & Sons, 1998)

One-quarter of all Americans will suffer from one of six major anxiety disorders during their lifetime: agoraphobia/panic disorder, specific phobia, social phobia, generalized anxiety disorder, obsessive-compulsive disorder, or post traumatic stress disorder. This guide offers a practical program for fast and long lasting relief from anxiety symptoms.

Infections and Inequalities

The Modern Plagues, by Paul Farmer '90 (University of California Press, 1999)

For nearly 15 years, Farmer has battled the HIV epidemic in rural Haiti and deadly strains of drug resistant tuberculosis in the slums of Peru. Drawing on these experiences, and using data from other parts of the world, he explores the social disparities that cause some to die from infectious diseases such as tuberculosis, malaria, and AIDS, while others are spared.

Consciousness

by J. Allan Hobson '59 (W.H. Freeman & Co., 1998)

Hobson explores the brain structures and functions now understood to be fundamental to conscious experience.

Using the theories and data of neuroscience, psychiatry, and neurophysiology, he guides his readers through the various states of waking, dreaming, and nonconsciousness. He also weaves in references to literature, philosophy, and his own experiences.

Office-Based Surgery in Otolaryngology

by John H. Krouse '84, Joseph P. Mirante, and Dewey A. Christmas, Jr. (W.B. Saunders Co., 1999)

The authors discuss the range of surgical procedures now being performed in otolaryngology offices. The text presents information from experts on cutting edge technology and surgical advancements that will broaden the range of office procedures otolaryngologists can perform. Chapters on anesthesia, office set-up, emergency management, nursing care, and billing and coding provide a practical framework.

The Heart Revolution

The B Vitamin Breakthrough that Lowers Homocysteine, Cuts Your Risk of Heart Disease, and Protects Your Health, by Kilmer McCully '59, Martha McCully, and Michelle Stacey (HarperCollins, 1999)

The authors challenge the long-held assumption that lowering cholesterol is the key to preventing heart disease. They introduce their theory that a vitamin B depleted food supply is the culprit behind heart disease. They explain the science behind their theory,

then provide readers with a plan for adding vitamin B to their diet, stopping arteriosclerosis, and cutting their risk of heart attack.

Pediatric AIDS

The Challenge of HIV Infection in Infants, Children, and Adolescents, Third Edition, edited by Philip A. Pizzo and Catherine M. Wilfert '62 (Lippincott Williams & Wilkins, 1998)

Although fewer children are now being born with HIV in the United States, the number of infected newborns continues to rise in developing countries. This comprehensive text presents care providers with the information needed to understand the nature and impact of AIDS, to define the current principles of care and management, and to predict future challenges.

The Developing Mind

Toward a Neurobiology of Interpersonal Experience, by Daniel J. Siegel '83 (Guilford Press, 1999)

This volume illuminates how and why neurobiology matters, integrating the latest findings from the fields of attachment research, memory, emotion, neuroscience, genetic research, and child psychopathology. Filled with examples from clinical practice and everyday life, chapters focus on how specific mental processes and cognitive abilities are fueled by emotional relationships throughout life.

Eating Disorders Follow Arrival of Television in Fiji

A DRAMATIC INCREASE IN EATING disorders among teenage girls in the Pacific island nation of Fiji may be linked to the recent introduction of television, HMS researchers report.

The sudden infusion of Western cultural images and values through television seems to be changing the way Fijian girls view themselves and their bodies, says Anne Becker '87, assistant professor of medical anthropology in the Department of Social Medicine. The result has been a sharp rise in eating

In her 1998 survey, conducted 38 months after television came to Nadroga, Fiji, 15 percent of girls, aged 17 on average, reported that they had vomited to control weight. By contrast, only 3 percent reported this behavior in 1995, just after television was introduced. In addition, the proportion of adolescent girls who scored high on a test indicating risk for eating disorders was 29 percent, compared to 13 percent three years earlier.

In 1998, 74 percent of the Fijian girls reported feeling "too big or fat" at least some of the time. Those who watched television a minimum of three nights a week were 50 percent more likely than others to consider themselves fat and 30 percent more likely to diet, although the more frequent television viewers were not more overweight. And 62 percent of Fijian high school girls reported dieting in the previous month, a percentage comparable to or even higher than those reported in studies in the United States.

Traditionally, Fijians have preferred robust body shapes for both

men and women, reflecting the importance placed on generous feeding and voracious eating.

"Your social position is based on how well you can feed other people," Becker says. "At any meal, especially when you're a guest, you're supposed to eat as much as you can—often beyond satiety." Fijian society has historically been vigilant about people viewed as under-eating, identifying a culture-specific illness called *macake*—essentially an

appetite disorder—and employing herbal medicines to stimulate appetite.

"They also have a culture-specific condition called 'going thin,' meaning losing noticeable weight," Becker adds. "If someone 'goes thin,' you assume there's some kind of underlying social problem."

Only in recent years, likely reflecting the encroachment of Western beauty ideals and values, have Fijians begun to be concerned about heaviness rather than just thinness. And the custom of caring for those who appear unhealthily thin has carried over so that people are now told frankly that they look too fat. The Fijian diet is in fact extremely high in fat, and Becker and her colleagues found that 84 percent of village women in their sample were overweight or obese.

Fiji has been developing from a traditional society, where cash was rarely used and possessions were widely shared, into one that participates in the global economy. Salaried employment and private property are becoming increasingly common, and the younger generation has begun to question the older generation's values.

"Fiji is essentially going from a subsistence agricultural society straight into the information age," Becker says. She sees the girls' desire to be slim as one sign that young Fijians are striving to conform to Western cultural standards. They also show a keen interest in the careers and workplaces depicted on television, looking to the characters as role models who can provide clues about their own prospects in a fast-changing world. Fijians often find it difficult to accept that television does not depict real life in the United States, Becker notes.

Fiji has only one television channel, which broadcasts mostly American, Australian, and British programs. Favorites include "Seinfeld," "Melrose Place," and "Xena, Warrior Princess."

"We can see [teenagers] on TV," one girl in the study said. "They are the



THIN IS IN: Within three years of the introduction of such American television programs as "Beverly Hills, 90210," eating disorders were on the rise in Fiji.

disorders. Becker presented preliminary findings at the American Psychiatric Association's annual meeting in May.

Eating disorders, including anorexia and bulimia, are most common in industrialized Western countries, and epidemiologic data suggest culture plays a central role. But Becker says she knows of no published studies using longitudinal ethnographic and survey data to document the onset of eating disorders amid cultural change.

same ages, but they are working, they are slim and very tall, and they are cute, nice. We want our bodies to become like that...so we try to lose a lot of weight."

Another noted that "since the characters [on 'Beverly Hills, 90210'] are slim built, [my friends] come and tell me that they would also like to look like that. They change their mood, their hair-styles, so that they can be like those characters. To be like them, I have to work on myself, by exercising and changing my eating habits."

Advising these girls on dietary matters is tricky, Becker says. Their health might benefit if they chose food that had less fat than those foods in the traditional Fijian diet. Yet an overemphasis on avoiding fat and keeping trim—besides defying cultural norms—might encourage induced vomiting and other unhealthy behaviors.

"We have a set of vulnerable teens consuming television," Becker says. "There's a huge disparity between what they see on television and what they look like themselves—that goes not only for clothing, hairstyles, and skin color, but also size of bodies." ■



Toy Muscles Linked to Harmful Image of Male Body

BETWEEN THE ORIGINAL G.I. Joe Land Adventurer of 1964 and the G.I. Joe Extreme Sergeant Savage of 1998 are 30 years of data on the cultural image of the American male. Harrison Pope '74, professor of psychiatry at McLean Hospital, and his colleagues have studied the data to evaluate how boys' action figures reflect the changing ideals of the male body image—much as the Barbie doll may reflect an idealized image of women in American culture.

Using G.I. Joe and Star Wars action figures, the only two lines of toys that met the criteria of popularity and length of time on the market, Pope and colleagues studied changes in body measurements and general appearance over time. They found that waist sizes have remained constant and close to normal in proportion to body size but that chest and biceps measurements started above average and have ballooned—in the case of biceps, from a scaled 12 inches to 26 inches.

"The G.I. Joe Extreme's arms are

larger than those of any bodybuilder in history," says Pope. "Mark McGwire's biceps wouldn't even come close." Similarly, the degree of muscle definition has become more extreme, with many toys now sporting rippled midribs and bulging pectoral muscles.

"Our increasing cultural emphasis on male muscularity, as exemplified by these action toys, should not be underestimated," says Pope. "Our society's worship of muscularity may cause increasing numbers of men to develop pathological shame about their bodies, to become obsessed with working out, and to take dangerous drugs, such as anabolic steroids." But at the same time, he cautions, these data should be examined along with data from movies and advertisements; the muscularity of these toys may be an effect, and not necessarily a cause, of the cultural obsession.

"The toys themselves do not cause boys to become neurotic about their appearance," says Pope. "Rather, we believe that the toys are symptomatic of a more general trend in our society toward an increasingly muscular ideal male body image. That trend, in turn, may be causing an increase in male body image disorders." ■



BODY BUILDERS: Star Wars hero Luke Skywalker bulks up between 1978 and 1995 (left); the original G.I. Joe from 1964, G.I. Joe Grunt from 1982, and G.I. Joe Extreme from 1997 (above).

Musical healing

A physician-turned-orchestra
conductor prescribes song

by SAMUEL WONG

IN A DARK CORNER OF A VETERANS' HOSPITAL LIES A MAN exiled from this world. He barely moves, eats little, does not speak, recognizes no one. His face, a stubbly mess, shows neither pleasure nor displeasure—just a constant indifference ever since a stroke devastated him ten years ago. An artery in his left brain had ruptured, spilling a river of blood in his head, drowning out reason and memories, clogging his once brilliant mind. His family left him long ago.

Now this man lies on a miserable cot, vacant and opaque. He looks a decade older than his 67 years. His face is gnarled and unshaven, his streaks of white hair are in disarray, his mouth is twisted and drooling. His eyes stare at the fluorescent light above, an artificial brightness that never varies.

Face to face with him, I start singing an old Anglican hymn, "Come down O love divine." His face stirs with recognition, his eyes begin searching, his breath quickens, his right hand twitches. I sing another verse, and another. I now see his face wince, question, beg, protest. His breathing has become irregular, his face human. His mouth tenses in an effort to speak; warm tears soak his eyes.



Today, as we discover its boundless potential, music anxiety, reclaim lost memories, enhance learning, and

Every week I would sing to this man, and every week I would witness a remarkable awakening. He never spoke, but would join in the singing of hymns with his feeble, eggshell voice. It was as if after years of hibernation, he was starting to thaw, to move, to live again. Through this window of music, a ray of light seemed to shine from the outside world directly onto his soul.

Throughout history, music has been used to invoke God, call armies to war, marry, bury, baptize, and express the sublime and the beautiful. The Bible describes David's playing his harp to ease King Saul's physical and mental suffering. Today, as we discover its boundless potential, music is used in hospitals and clinics to alleviate pain, reduce anxiety, reclaim lost memories, enhance learning, and restore order, beauty, hope, and meaning in patients' lives. I have always believed in the tremendous power of music to reach the soul and to promote physical and emotional wellness. After leaving medicine to pursue a full-time career in orchestra conducting, I return sometimes to the corridors of healing, this time bearing song.

On a Tuesday afternoon in the Bronx, at Beth Abraham Hospital, where neurologist Oliver Sacks founded the Institute for Music and Neurologic Function, I am leading a music session with six patients. After starting with some simple harmonies and a slow rocking rhythm on a Yamaha keyboard, I invite Molly,* a 76-year old

aphasic from Dublin, to improvise a little ditty. "Oh Danny boy, how I miss you, my Danny boy," she sings, her voice strong and eloquent. Just a moment ago she could not speak the simplest words. Next Rosita, briefly lucid and coherent from her dementia, sings in Spanish, "How much pain and suffering we must forget, my love, after all these years." And then, as he stares down at

United by adversity, loneliness, and disease, six people—from Ireland, Cuba, Jamaica, and New York City—pour their hearts out in song.

An hour later, I am beating on a xylophone with joyful abandon. New harmonies and rhythmic variations emerge as 15 chronic neurological patients play guitars, maracas, tambourines, and tom-toms. Some are in wheelchairs,

some are on gurneys, others are sitting by IV poles, but all are beating, strumming, shaking, making a joyful noise.

Rocky, a young black man with multiple sclerosis, perks up at the reprise of a song, letting out a salvo of excitement on his snare drums. Marino's eyes glow with recognition and pleasure as he shakes his maracas even more vigorously, seemingly free of his Parkinsonian tremor. Rose laughs, lifted from her depression, as she senses the infectious rise of tempo and spirit. Rules of the house: everyone must play or sing, no

matter what instrument is wielded or what position is assumed. No infirmity is too great for this chamber music.

In a recovery room on another floor of the hospital, Mrs. Miller, a plump, retired schoolteacher who has just had her gallbladder removed, wakes up gradually to her favorite Mozart piano concerto. "I play K. 466 whenever I feel anxious or distraught," she tells me. "The music dissolves my pain and worries. I came into the world listening to *Eine kleine Nachtmusik*, and I will go to my Maker with the *Lacrymosa* of Mozart's *Requiem*."



GETTING RHYTHM: Connie Tomaino, director of music therapy at the Institute for Music and Neurologic Function, uses the rhythm and pacing inherent in music to help a patient with severe dysarthria improve her vocal tone and intelligibility.

his confining wheelchair, Robert, a rotund black man, joins in, "Oh yes, how I miss my Emily, and my son in Alabam, how I wish I could walk again, then I could walk to them."

And so the musical improvisation goes, stitching memories, yearnings, and sorrows together in a motley quilt.

*The names of patients have been changed.

is used in hospitals and clinics to alleviate pain, reduce
restore order, beauty, hope, and meaning in patients' lives.

The right music, in the right setting, transports her, she says, to a different plane of consciousness.

Reports and anecdotes from around the world support Mrs. Miller's beliefs about the healing benefits of music. Studies covering everyone from delivering mothers to cancer patients have demonstrated the phenomenal soothing power of music, which can speed recovery, ease pain, and reduce anxiety, stress levels, and even arterial pressure.

In England, patients who listened to classical music while undergoing local anesthesia recovered more quickly and reported fewer complications. In Canada, patients exposed to 15 minutes of soothing music needed half the sedatives and anesthetic drugs that other patients required. In Poland, patients with severe headaches had significantly less need for medication when exposed to concert music for six months. And in Japan, surgical patients listening to music just before anesthesia had increased levels of alpha brain waves and decreased levels of stress hormones.

At the University of Colorado, researchers were able to reduce patients' mean arterial pressure, both systole and diastole, by playing "sedative music." In Austin, Texas, women had a decreased need for anesthesia during childbirth when listening to music. In Provo, Utah, babies who regularly heard live singing gained more weight and were released from the intensive care unit three days earlier than those who didn't. In a study in three New York hospitals, babies exposed to Brahms' *Lullaby* six times a day were ready to go home a week earlier than controls. And at UMass Memorial Health Care, harp music is prescribed in lieu of tranquilizers for cancer patients.



Perhaps more impressively, music has proved effective in treating a range of neurological and psychological disorders. Researchers in Colorado found that a half hour of rhythmic stimulation each day improved cadence, stride, and foot placement in stroke patients. A University of California, Los Angeles study showed a 59 percent reduction in auditory hallucinations in hospitalized

schizophrenics who listened to music. A music professor at Northern Illinois University taught patients with Parkinson's disease to play the harp in groups; many of these patients achieved remarkable fluidity and freedom of movement. Other studies have found significant increases in concentration, learning, and lucidity among children with learning disabilities and autism.



M

usic can release memories—not just randomly, but as part of a coherent picture.

I have witnessed musical miracles at Beth Abraham Hospital, where familiar songs are played to stroke and Parkinson's patients, resulting in remarkable fluency of movement and gait. And I have seen music engender other awakenings. A movement from a Mozart piano concerto, a phrase from a Schubert lied, a chorus from Handel's *Messiah*, and a Cole Porter love ballad have all brought about total lucidity and humanness, if only for a moment.

With music, those whose true selves have been locked away can feel whole again, regain the self, and recall a world inhabited by loved ones, filled with passion and longing, and ordered by knowledge and learning—a world that resonates with meaning. To patients with deranged memory, music can be a Proustian mnemonic. Faces, words, and names seem like loose pieces of timber, scattered, meaningless, floating aimlessly down the river of time. No matter how much patients try with medication, physical therapy, and reading, they cannot hold these pieces of wood together again. Music can be the key that releases a flood of memories—not just randomly, but as part of a coherent picture.

Music does not lead us by the hand, but initiates our walk in the right direction, builds bridges to carry us across devastated landscapes, and sustains us in our inner search when we fatigue from repeated effort. Because music bypasses the usual circuits of word retrieval, facial recognition, list recollection, and mathematical calculation, a beam of light shines directly onto our emotional core. Raw, uncut,

and unstoppable, music burns a seal into our hearts, wrenches our guts, makes us shudder with fear or sing with joy.

We can stop listening, but we cannot stop *hearing*. Ever since we were in the womb, we have heard the primordial, incessant drumming of our mother's heartbeat, a rhythm that is embla-

child abuse, and amnesia? If music can uplift the depressed, why not also the aged, the restrained, the immobile, the spiritually disaffected? If music can bypass language to reach the emotional core of those in the throes of disease and devastation, why not also the emotional core of those maintaining their well-being?

Down the hall from my music group of neurological patients at Beth Abraham Hospital, Connie Tamaino, the director of music therapy, is playing accordion for Edward, a life-loving black gentleman who suffered a severe stroke. His left hand is contracted and stiff, his left leg lifeless and heavy on his wheelchair pedal. His speech is halting at best; at worst, he cannot get anything out, and his eyes glare with effort. He can see the words as if on a page, but he cannot release them into fluent speech. And yet, when he sings, lyrics come effortlessly. Even when he stops singing, if he simply *thinks* about singing, his words arrive more easily.

"It's gotta be you!" he sings, as he gesticulates with his right hand, almost conducting, with delirious freedom. When the music stops, he wrings his hands and sighs. "I ccc-can't, ccc-can't ggg-get...Ach!" He is stuck again. But when he starts to sing his sentences, his fluidity returns. He has come a long way since his stroke. With music, he has regained fluency, dignity, and meaning in his compromised life. ■

Samuel Wong '88 is music director of the Hong Kong Philharmonic, the Honolulu Symphony, and New York City's Mannes College of Music. This essay will appear in expanded form in his forthcoming memoir on music and medicine.



DIFFERENT DRUMMERS: Percussion instruments can be modified to match each patient's ability. Here, drums are used to increase range of motion and muscle strength in a patient recovering from a stroke.

zoned into our neuronal circuits, pulsating daily within our core. This internal music has never left us and is the key to unlocking primitive memories and reconstructing our internal order.

If music can be used to recover memories in Alzheimer's patients, why not in the surfacing and treatment of post-traumatic stress, rape,

Cerebral *Symphony*

How do the miniature orchestras
in our brains translate music?

by DEBRA MALINA

THE CONDUCTOR LIFTS THE BATON, AND hundreds of eyes focus on a single point in space. The baton takes its first dramatic dive, and the violin bows begin to glide in unison, the flutes climb the scale, the drums rumble, the cellos spring to life. On cue, each instrument, speaking in its unique timbre, plays a different part of the score, some contributing to the developing melody, some providing rich harmony. Somehow, magically, the complex sounds join to create a unified aesthetic event, a temporally evolving yet remarkably cohesive auditory, cognitive, and emotional experience.

The magic at work began in the brain of the composer, but would prove utterly ineffectual if it were not also reproduced in the brain of each listener. There, in the still-mysterious gray matter within each human skull, a miniature orchestra apparently replicates the intricate coordination of sophisticated and well-tuned practitioners. Toward the front of the brain, the prefrontal cortex—what Mark Jude Tramo, director of the Institute for Music and Brain Science at Massachusetts General Hospital calls “the brain’s conductor”—brings together the complex efforts of multiple and widespread “musicians.”

NEUTRAL ON CARBON DIOXIDE





good deal of auditory and other perceptual It is as if science tries to understand through

Far from clustering together in the right hemisphere, as a decades-old hypothesis would have it, the players in question seem to reside in many areas of the brain. They range from the right hemisphere's superior temporal cortex, which analyzes harmonic patterns in music; to the left hemisphere's superior temporal cortex, which processes lyrics and rapid temporal changes in music; to frontal, temporal, striatal, and cerebellar systems that process time patterns in melody and rhythm. Musical messages are relayed to emotional centers, such as the amygdala and hypothalamus, which influence blood pressure and pulse rate.

All this work, merely to sit quietly in one's seat, passively listening to music. What elaborate machinery must be whirring away in the skulls of the orchestra members themselves? After all, as Jerome Kagan, the Daniel and Amy Starch Professor of Psychology at Harvard, has shown, listeners can discern the difference between consonant and dissonant music—and prefer the former—even at the tender age of four months. But no infant, however precocious, can take up a violin and perform a Mozart concerto.

Active participation in music requires still more neurons, more areas of the brain: musicians must call on parts that process symbols and parts that interpret, translate, and manipulate spatial relations. To maneuver their hands properly, they must use the motor cortexes of both left and right hemispheres; to coordinate that bimanual movement, they need the corpus collosum. Those with perfect pitch apparently rely heavily upon the

left planum temporale, a part of the brain that may be involved in categorical perception.

Leonard Bernstein described what he called the "phonology" of music, the fundamental system of elements, such as pitch and timbre, upon which musical syntax and semantics are built. Pitch, for example, is the basic building block of melody (successive pitches), tonal consonance (simultaneous pitches), and harmony (successions of simultaneous pitches).

"But even if we break it down that way, each major module has multiple functional subcomponents," says Tramo. "Timbre breaks down further into steady-state aspects and time-varying aspects of timbre processing, and different parts of the brain are involved to varying degrees with distinct functional subcomponents." Much reductionist research still needs to be done, Tramo adds, in order to identify the neurons in which the multiple activities are taking place; only then can researchers hope to piece together the big picture and to grapple with the seemingly universal human relationship with music as an art form.



processing actually involves a major temporal component. snapshots phenomena that can only be captured in movies.

It is this very complexity that attracted Peter Cariani, assistant professor in otology and laryngology at the Massachusetts Eye and Ear Infirmary, to the study of the neurobiology of pitch perception. "Music has an incredibly elegant structure," explains Cariani, "and the real mystery, if you're trying to understand how the brain works, is why we would perceive this structure in the way we do, and why it would have such a profound effect on us. Music has perceptual, cognitive, and emotional complexity that rivals that of spoken language, but there is no obvious evolutionary reason why we should so easily be able to make sense of it."

Keeping Time to the Music

To date, only scattered pieces of the puzzle have been found; in general, according to Cariani, the nature of the brain's perceptual representations remains a mystery. "Textbooks, in their attempt to simplify the explanation of sensory representations, often neglect whole classes of alternative representational strategies," he says. One fundamental error, he says, is that many neuroscientists try to map out brain function solely in terms of spatial representations, while a good deal of auditory and other perceptual processing actually involves a major temporal component. It is as if science tries to understand through snapshots phenomena that can only be captured in movies.

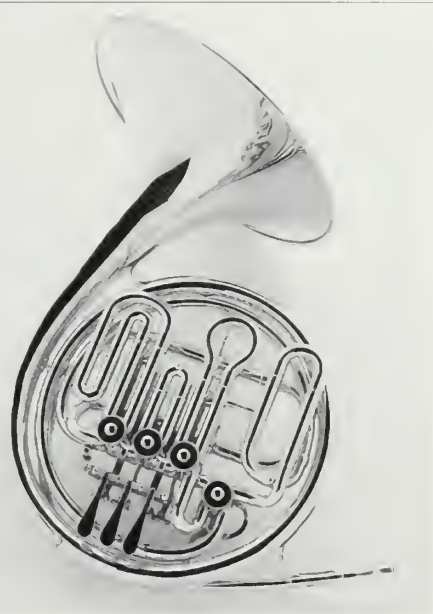
A traditional model for the encoding of musical pitch in neural signals involves, for example, "the spatial mapping of frequency in the auditory system from inner ear to cortex," explains Martin McKinney, a former electrical engineer turned auditory physiologist. Now

working on his doctorate in the Harvard-MIT Division of Health Sciences and Technology, McKinney is trying to determine, using different stimulus paradigms, the comparative accuracy of the spatial-map model of pitch perception and an alternate temporal model.

This second model—the one Cariani embraces—is built upon the temporal patterns in nerve firings: not which neurons fire how much, but when and how frequently the firings take place, a pattern called the "interspike interval code." Cariani's research with Bertrand Delgutte, associate professor of otology and laryngology at the Massachusetts Eye and Ear Infirmary, has demonstrated, Cariani says, that "the statistics of interspike intervals taken across the entire auditory nerve array correspond very closely with the pitches that a human listener hears."

If this time-centered understanding proves accurate, Cariani believes it will answer the question of music's function. "If the nature of the system is to encode time—temporal relations, using temporal patterns," says Cariani, "then it becomes part of the generalized system the brain uses to extract invariances in its inputs, and the basic structure of hearing and the interval codes for pitch perception will turn out to be phylogenetically primitive."

In other words, Cariani says, the harmonic structure that underlies our perception of both musical pitches and musical intervals—such as octaves, fifths, and fourths—may have a basis in the neural codes that the auditory system uses to represent sounds. We hear



similarities between tones an octave apart because they produce many of the same interspike intervals. Thus, Cariani would argue, it is not—or not *only*—the coordinated, multi-part structure of the orchestra that is reflected in the brain, but the structure of music itself.

The significant and fundamental reconceptualization of the brain inherent in a temporal approach has long been represented in a "minority tradition," according to Cariani, but it has been overshadowed by the mappable visions of the devotees of spatial representations. This bias toward visual representation seems related to another apparent bias in neuroscience: relatively few neuroscientists have opted to study the auditory sense, focusing, especially in recent decades, primarily on the visual.

According to Tramo, the problems involved in communicating on noisy World War II battlefields once brought armies of auditory perception researchers to Harvard and MIT for concerted efforts in psychoacoustics—efforts that Harvard disbanded in the 1970s. Also, in the 1930s and 1940s,



ince conducting auditory research requires a has mostly been the province of electrical and

Ma Bell invested in auditory research, says Cariani, seeking a model of human hearing that would allow it to optimize the telephone system. He adds that some of the first neural networks used to explain complex perceptual phenomena successfully were auditory

models for binaural hearing and pitch perception. But since conducting auditory research requires a great deal of signal processing and acoustics, the field has mostly been the province of electrical and audio engineers rather than neuroscientists, and research has

tended to emphasize the cochlea rather than more central auditory processing.

Studying the intricate workings of the auditory cortex and its collaborators is admittedly difficult. For one thing, Cariani points out, most of the work has been done in anesthetized animals, and as researchers study more and more higher-brain processes, this approach becomes increasingly problematic: anesthesia changes the coherence of firing patterns. "If that coherence is necessary for representing the sensory information, then you're not looking at the same thing," notes Cariani.

For even more obvious reasons, especially if activity is key, "looking at postmortem brains is too late," says Gottfried Schlaug, director of the Neuroimaging Laboratory at Beth Israel Deaconess Medical Center. "We would like to look at the living brain—its structure and function. Today's technology, such as magnetic resonance imaging, allows us to do that."

The Brains of Musicians

Since the early 1990s, medical technology has begun to facilitate far more sophisticated studies of the brain's macrostructure. Schlaug, for one, has undertaken a number of magnetic resonance

imaging studies comparing the brains of musicians with those of nonmusicians. The research began as an attempt to determine the validity of the long held

belief that music was a right hemisphere function and that right-handed musicians therefore must have a different hemispheric dominance than right-handed nonmusicians. In a sense, it was an effort to find a biological basis for musical talent, an

timbre



great deal of signal-processing and acoustics, the field audio engineers rather than neuroscientists.

anatomical predisposition to virtuosity. Schlaug began by studying the planum temporale, an accepted marker of hemispheric dominance and a structure that is involved in auditory processing as well as in categorical perception.

Along the way, Schlaug encountered some surprises. Not only did the musicians fail to show a dominance of the right hemisphere; they actually had a more pronounced left hemisphere dominance than the control group of nonmusicians. But the difference was apparent only in those musicians who had perfect—or absolute—pitch, in whom the planum temporale had apparently grown on the left side of the brain and shrunk on the right. Although Schlaug believes that planum temporale asymmetry may well be genetically coded, his work has also convinced him that musical training is essential. “People are not born with absolute pitch,” he says.

Such a finding leads to a whole new arena for research: not only must we understand how the brain processes music, but we must also determine how processing and playing music affect the brain. For if we are born with a predetermined brain anatomy, we make the circuits required for various tasks only through exercise.

“The modern buzzword in neurobiology for plasticity in learning and brain development is ‘use it or lose it,’” says Mark Tramo. And the latest word on the key connections for musical ability is “use it early.” According to Schlaug, to develop absolute pitch,



for example, a child must be exposed to music before the age of seven.

The same watershed seems significant for other music-related structural adaptations of the brain as well. The corpus callosum, which matures later than other parts of the brain, grows during the first decade of human life; in his studies, Schlaug found that the anterior part of the corpus callosum was larger in musicians than in nonmusicians, but only significantly so in those who began to learn music before the age of seven. Musicians also had larger cerebella than nonmusicians and greater symmetry in their motor cortex due to a more pronounced enlargement of the non dominant motor cortex in musicians, although the dominant-hand side of that cortex was also larger

than that of nonmusicians. Again, says Schlaug, the earlier musicians begin their training, the more pronounced the differences are.

Of course, even with the assistance of magnetic resonance imaging, these macrostructural comparison studies run into obstacles. For instance, it is difficult to measure musical skills and success, notes Schlaug, because virtuoso performance requires more than impeccable brain function—the performer also must be adept at such tasks as controlling emotions and overcoming nervousness. Then, more tellingly, even when strong musicians have been identified, it is difficult to find appropriate nonmusician controls, because, says Schlaug, “musicians tend to test very high on any kind of behavioral or IQ test you give them.”

This latter dilemma alone suggests that all this research should have some obvious educational applications. Although Schlaug warns that “we haven’t shown that having these neurological changes is beneficial” in and of itself, it is, at the very least, a great boon for would-be musicians. Seldom, says Schlaug, will you find an expert musician who began playing after the age of ten. But if these, or any, brain adaptations do turn out to be generally beneficial, the research makes clear that they must be made early.

“The brain is certainly plastic in the first decade of human life,” says Schlaug, “and it’s more plastic in the first half of that decade than in the second. So it’s better to start musical training in preschool or kindergarten than in

Research is beginning to suggest, however tentatively, verbal memory to more skillful abstract reasoning,

elementary school. And actively participating in music is better than just listening to music.”

If changes in brain structure seem an abstract goal, though, it may help to consider the skills honed by music-inspired exercise of the brain. For, as Tramo argues, we regularly generalize the use of skills from one specific task to other related ones. Because performing music requires the development of so many and such varied skills, it inevitably strengthens a gamut of abilities.

For instance, to play an instrument, Tramo says, “you have to learn to put together the sound of something, the sight of something, and the movement of fingers, superimposed on a background rhythm—all in real time. The distances along the musical instrument you’re manipulating and the distances in the score you’re reading require a refinement of spatial processing. Reading and writing music involves symbol manipulation, with respect to certain rules of usage. And it’s not a stretch to think that processing in those general domains then enhances processing in whatever domains get measured by aptitude tests, or whatever domains you need to have a successful career.”

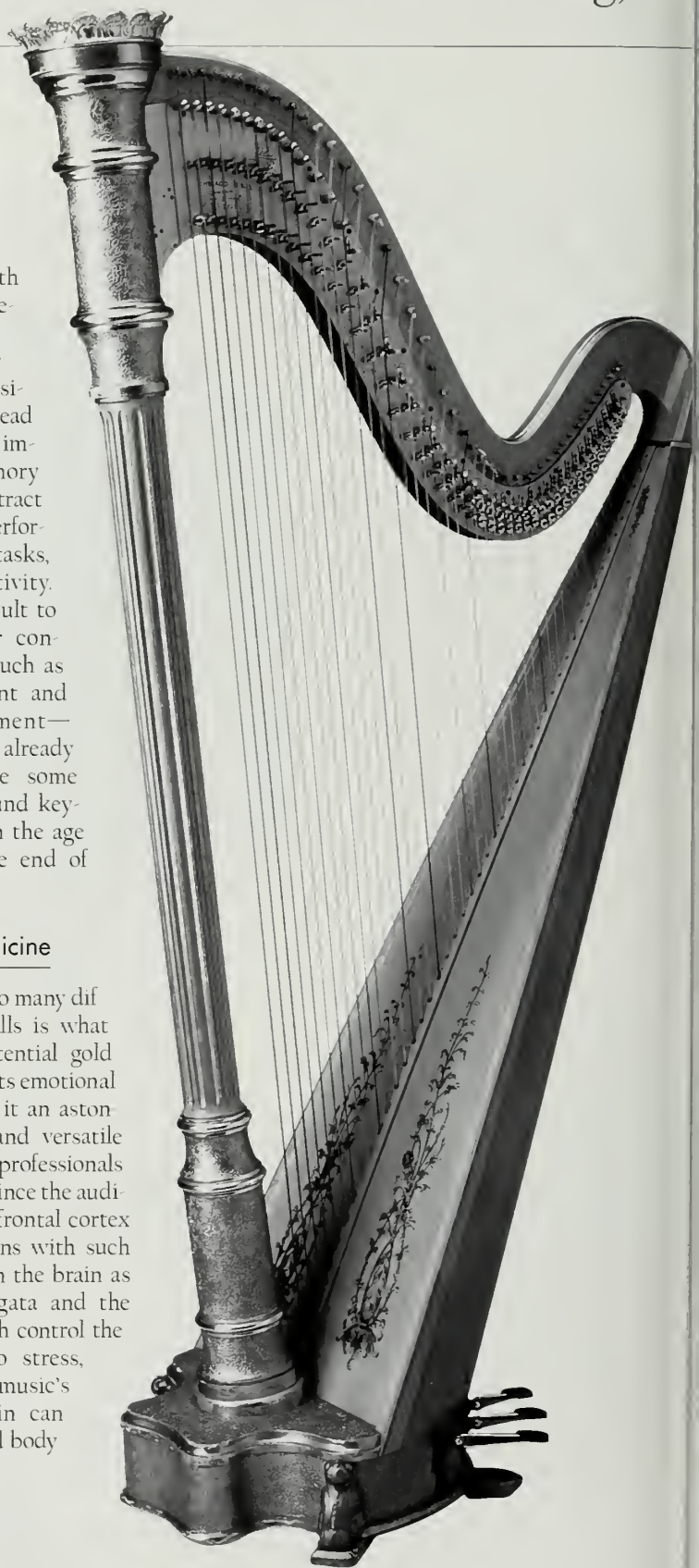
“More importantly,” says Tramo, “kids love music. It’s hard to get a kid to sit down and do anything that taps into that many different domains—cognitive, perceptual, and motor—and music really does that in a big way. But it’s also fun and exciting.” On the other hand, he warns, music isn’t for everyone, and parents and teachers should

not force it on resistant children.

But for those with the inclination, research is beginning to suggest, however tentatively, that musical training might lead to everything from improved verbal memory to more skillful abstract reasoning, better performance on spatial tasks, and greater creativity. Although it is difficult to eliminate all other contributing factors—such as parental involvement and teacher reinforcement—such studies have already begun to convince some school boards to fund keyboard training from the age of five through the end of grade school.

Music as Medicine

If its reliance upon so many different cognitive skills is what makes music a potential gold mine for educators, its emotional component renders it an astonishingly powerful and versatile tool for health care professionals and patients alike. Since the auditory cortex and prefrontal cortex have rich connections with such emotional centers in the brain as the medulla oblongata and the hypothalamus, which control the body’s reactions to stress, explains Tramo, music’s action on the brain can soothe the mind and body as well as the soul.



that musical training might lead to everything from improved better performance on spatial tasks, and greater creativity.

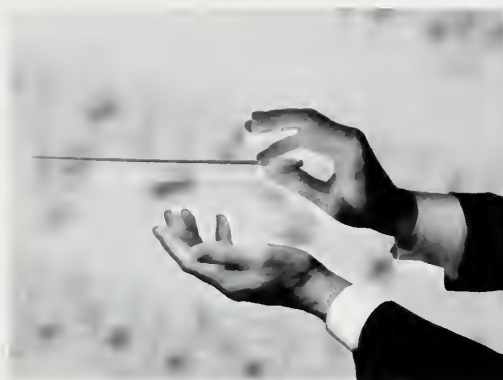
For instance, "if you have interoceptive stimuli—your knee hurts or you have cancer pain or psychic pain—then providing exteroceptive stimuli that are pleasing helps to mask the pain, and music is a pleasant stimulus for many people, so it works at the aesthetic level," says Tramo. Music also has been shown to benefit Alzheimer's patients, whose behavior tends to be very disorganized. "People with Alzheimer's have attentional problems and become agitated, and each new stimulus can be disconcerting," says Tramo. "Yet by providing stable, steady input, background music has been shown, for example, to reduce the number of mealtime fights among such patients."

Some music therapists have had success with autistic children, an effect, says Tramo, that "has a lot to do with communication and the children's intense phobias, both tactile and social." Music, as a universal language for expressing emotions, enables autistic children to communicate and understand feelings that they would

not be able to grasp or express through language.

In cardiac intensive care units, background music has been shown to reduce the number of hypertensive episodes. In this instance, says Tramo, the therapy "has a lot to do with autonomic control." But "the one that really gets me," he says, "is that in hospitals where premature infants in incubators are hooked up to heart and respiratory monitors, significantly fewer alarms sound if music is playing."

If music itself can do wonders for the brain, an understanding of music has also led to therapeutic advances through an improved comprehension of auditory functioning. Most prominently, the work of researchers such as Tramo, Cariani, and McKinney is contributing to a more accurate coding model of neural responses to acoustic stimulation; this, in turn, will inform development of more effective cochlear implants.



More abstractly, but perhaps most promisingly, the growing research on music processing seems to be leading neuroscientists to a more complete and accurate understanding of the mysterious workings of that elaborate, well-orchestrated machine between our ears. In the long run, the most significant application of knowing what makes us strum or thrum or trill or croon may turn out to be a new comprehension of what makes us tick. ■

Debra Malina is a freelance writer based in Cambridge, Massachusetts.

musical notes

- ◆ Composers Hector Berlioz (1803–1869) and Aleksandr Borodin (1834–1887) trained in medicine; physicians Hermann Baerhaave (1668–1738) and Albert Schweitzer (1875–1965) trained in music.
- ◆ In a survey of more than 1,000 Norwegian doctors, 56 percent could play at least one instrument, compared to 47 percent of university graduates. Psychiatrists were more likely than other specialists to play an instrument regularly, and primary care physicians were more likely to be members of an orchestra or a choir.
- ◆ Studies have shown that doctors who have received musical training tend to be more skilled at auscultation than those without any musical training.
- ◆ Ary Goldberger, a cardiologist at Beth Israel Deaconess Medical Center, has found that the range of heart rate variability is nearly identical to the musical spectrum, mapping almost perfectly over a Brandenburg concerto.

Tuning up musicians

Harvard doctors treat the injuries
of musical performers

by PHYLLIS L. FAGELL

KATE* WAS A RISING STAR IN A MAJOR BROADWAY MUSICAL WHEN SHE lost her voice. She had always been a powerful singer, able to push herself to the limit. But now, to deliver the same volume, she had to strain her vocal cords. She continued to belt out eight shows a week, until disaster struck.

"I felt my body say, 'I don't know what you're going to do, but I'm going to stop,'" Kate says. She developed bronchitis and coughed for three weeks. Still, she didn't seek help until a blood vessel on her vocal cord hemorrhaged. She knew then that if she didn't get treatment, her voice would be in jeopardy.

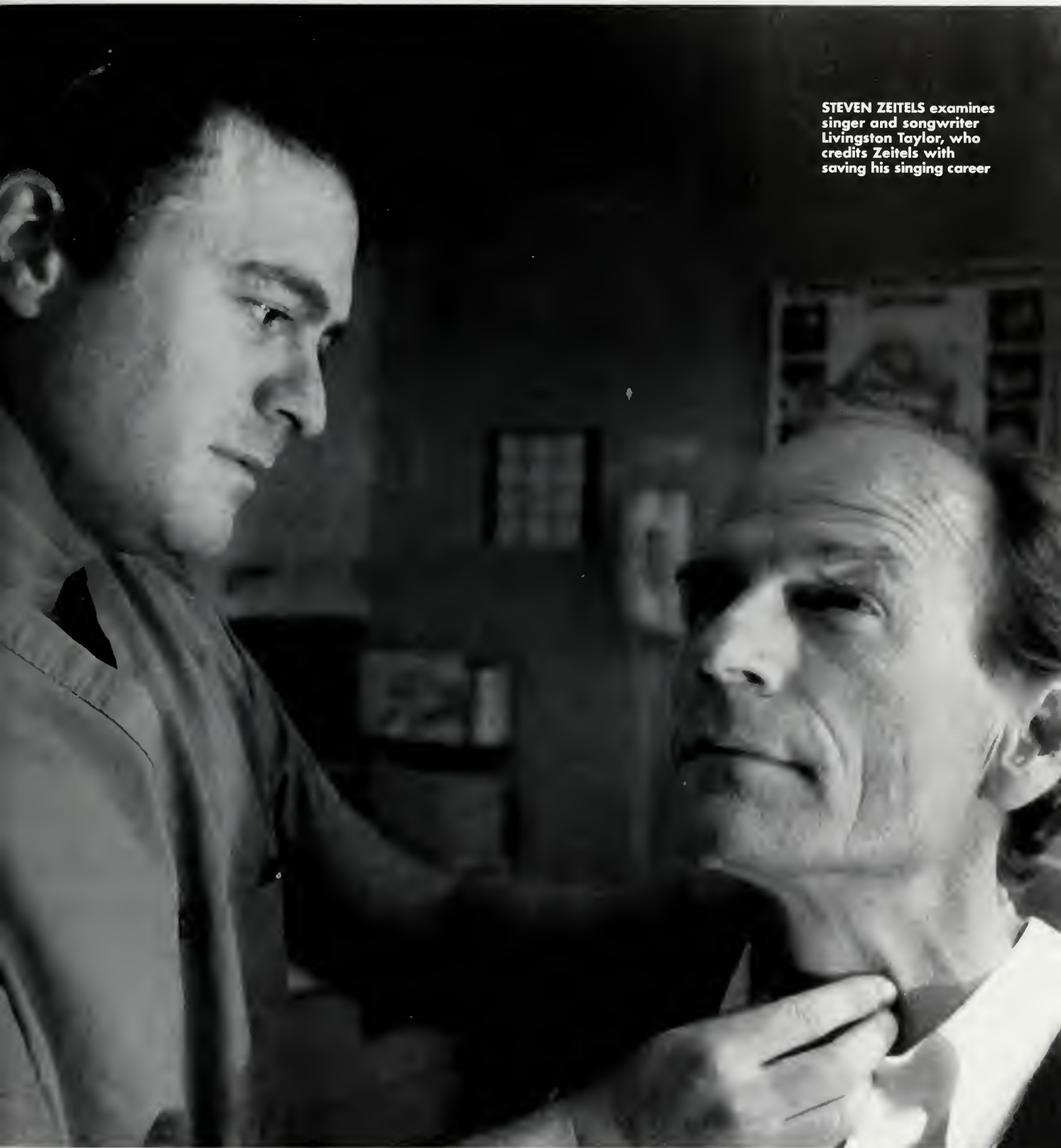
"A doctor in New York told me I had to stop singing," Kate says. "But I'd been singing since I was six, and quitting was not an option." So she flew to Boston to see Steven Zeitels, a laryngologist and head and neck surgeon at the Massachusetts Eye and Ear Infirmary. Zeitels has a reputation in the music industry for saving performers' careers.

"He didn't promise anything," Kate says, "but I trusted him completely." Zeitels removed the tiny blood vessels and gave strict instructions. She was forbidden to speak one week before and two weeks after surgery. Then, for one week, she was allowed to talk only in moderation.

* Names with an asterisk have been changed.

PHOTO: TOM HERLI - ROYALTY FREE

STEVEN ZEITELS examines
singer and songwriter
Livingston Taylor, who
credits Zeitels with
saving his singing career



Surgeons like myself are very visual—our instruments hear everything and are relatively blind, and the

"He taught me how to stay hydrated, how to eat, how to preserve my instrument," Kate says. Zeitels stressed the importance of sufficient sleep, voice therapy, and avoiding acidic foods, caffeine, alcohol, menthol, and overuse of her voice.

"I followed every rule," she says, "and things have changed. I'm getting flown to London to sing for Sony Music, and I'm auditioning well for Broadway shows. Before, I was living in fear. Now I sing with a new light."

Taking Notes

When Zeitels, always a music lover, joined the Massachusetts Eye and Ear Infirmary in 1990, he realized that no local otolaryngologists were dedicating themselves to treating vocal injuries in singers. "Treating vocalists' injuries isn't part of one's typical training in otolaryngology residency programs," he says. "I taught myself, patients taught me—it was a real exchange." About one-third of his patients now are performers; their signed photographs decorate his office walls.

Singers and their coaches tend to notice vocal injuries before an audience can detect them, Zeitels says. "The teachers have amazing acoustic perception," he adds. "Surgeons like myself are very visual—our instruments allow us to see microscopically. So in a sense the teachers hear everything and are relatively blind, and the surgeons see everything but are relatively deaf."

At first, singers compensate for injuries with greater air support and muscle control. "They work harder to achieve the same acoustical outcome,



GARY CHERONE, lead singer for Van Halen, shown above and left (with guitarist Eddie Van Halen). Cherone's rock-and-roll lifestyle took its toll on his voice. For a while, he tried to mask the changes: He would ask his band to sing the high notes while he climbed a pole to distract the audience. But when he could no longer rely on his falsetto, he sought help from Harvard physician Steven Zeitels.

so their stamina decreases," Zeitels says. "Then their acoustical outcome deteriorates—they simply don't sound as good." But most performers don't seek help until "they can't get through a show."

At that stage, Zeitels conducts a laryngeal stroboscopy, which enables him to watch the vocal folds vibrate in slow motion. He also does a complete head and neck exam. "At that point, I can make a number of diag-

noses," he says. The most common injuries to singers arise from oversinging, infections, acid reflux, and allergies, which can result in hoarseness, laryngitis, and lesions on the vocal cords.

Any problems that can be addressed without surgery are tackled first. "We may put patients on vocal rest or adjust their activities," Zeitels says. Reflux, which often arises because singers rely heavily on

allow us to see microscopically. So in a sense the teachers surgeons see everything but are relatively deaf.”

intra-abdominal support, may be treated with medication or behavior and diet modifications. Dehydrated singers are urged to drink more fluids. And for singers with phlegm on their vocal cords, Zeitels may prescribe mucolytics.

Performers are further advised to correct poor technique by working with a voice therapist. Zeitels refers patients to a few classically trained singers who also are speech pathologists. When famous singers have other demands on their voices besides performing, Zeitels may restrict their press interviews. And he advises young people who are just developing their careers and supporting themselves with second jobs to avoid overusing their voices at work.

When do performers need surgery? “Generally, when there’s a lesion,” Zeitels says. “Most problems associated with the larynx that we treat with surgery are the result of trauma—either from overuse or from past surgery.” To enable further research on the treatment options for such injuries, the Massachusetts Eye and Ear Infirmary has created one of the nation’s first laryngology divisions, which Zeitels now directs.

Surgical Successes

Singer and songwriter Livingston Taylor saw Zeitels as soon as he noticed a thickness in his voice and an inability to hit certain notes. He learned that he was hemorrhaging

into his vocal cords. “The alternative to surgery was that I was going to have to move into a station wagon in my mother’s driveway, and that made the option of surgery pleasant indeed,” Taylor says. “Steven removed the vessels, and that was the end of my problem. My singing is better today than it’s ever been.”

For Taylor, deciding to go public with his surgery was not a major decision. But less established performers often fear that disclosure could mean losing singing parts. Says Kate, the Broadway star, “I’ve paid a lot of dues and I’m still paying them. I just don’t have the strength to be the poster child. Producers and casting agents are businessmen. They see us as machines, not people.”

Jane,* an opera singer on whom Zeitels performed surgery, adds that the common perception in such cases is that the singer is at fault. “That’s always been the scarlet letter in this community: ‘Singer gets nodules because she pushed her voice.’”

Despite surgical success stories like those of Kate, Taylor, and Jane, Zeitels cautions, there’s a gray zone. “Vocalists can have a nodule and still sing fine. You have to analyze the situation carefully, because the risk of any procedure is that you can make the problem worse. Singing is their livelihood. It’s their spirit too, who and what they are.”



FRED HOCHBERG met with world-renowned pianist Gary Graffman 15 years ago, an encounter that triggered his desire to understand and treat musicians’ injuries.

I

love to tour and perform, and I'll do it as long as I can. My knees will probably give out before my throat."

Gary Cherone, lead singer of the rock band Van Halen and former lead singer of Extreme, came to Zeitels after "screaming too much." His on-the-road lifestyle and bad habits, such as failing to warm up his voice or to drink enough fluids, were taking their toll. "In rock-and-roll, you let loose," he says. "Singing correctly is not the first thing you think of. You're not doing Pavarotti."

For a while, Cherone was able to camouflage moments when his voice cracked. The volume of the music and the adrenaline rush from performing to crowds helped him compensate. And when that wasn't enough, he would seek his band's help. "I'd ask the guys to cover me," he says. "They'd take the high notes and I'd climb a pole, anything to distract."

Cherone credits Zeitels with saving his career. "He found the problem just by listening to my voice. At first, when I was in Extreme, my voice was just raspier, which I actually liked. But then little cracks started coming out in rehearsal, and I couldn't rely on my falsetto."

Zeitels removed a nodule, and, just two months after the surgery, Cherone performed in the rock opera *Jesus Christ Superstar*. Then Extreme disbanded and Cherone flew to Los Angeles to audition for Van Halen.

"If I hadn't had the operation," Cherone says, "I wouldn't be where I am now. I love to tour and perform, and I'll do it as long as I can. My knees will probably give out before my throat."

Piecing Together a Mystery

Singers are not the only performers who struggle with career threatening injuries. Fred Hochberg, a neurologist at Massachusetts General Hospital, began treating instrumentalists' injuries about 15 years ago, when a friend asked him to meet with Gary Graffman, a world-renowned pianist who was having difficulty with his right hand.

"He couldn't lift his fourth finger," Hochberg says. "And he wasn't the only one—he had a list of friends with the same problem. These were pianists who played the same repertoire, what are called the heroic pieces."

Lifting the ring finger is difficult because it is inextricably tied to the middle and small fingers, Hochberg explains. "The tendons supplying the ability to extend the fourth finger are actually linked to the middle and small fingers. In the 1850s, barbers, who were prototype surgeons, used to cut the junctura, which is the linkage, to give pianists independent movement."

But that clearly wasn't an option for Graffman. Despite physical therapy and other interventions, he could not perform another concert. Hochberg was determined to try to solve the mystery.

MICHAEL CHARNESS works with patient Marie Fukuda, a freelance chamber musician, at the performing arts clinic at Brigham and Women's Hospital.





PHOTO: TOM ARONSON/BRIGHAM AND WOMEN'S HOSPITAL

Perhaps the source of the problem, Hochberg speculated, was the big, orchestral, highly percussive Brahms and Tchaikovsky pieces that Graffman played. Or maybe his training had somehow contributed to the problem, much as a tennis player who learns to serve improperly might develop rotator cuff injuries. After all, the first three patients Hochberg saw with this problem had all been trained by Nadia Boulanger in the same Paris apartment.

Then Hochberg theorized that perhaps Ashkenazi Jews were afflicted with this particular occupational "dystonia," a painless uncontrolled movement that affected his pianist patients only when they were playing their instrument. But after the gene for one form of dystonia was discovered, Hochberg's patients tested negative for that genetic abnormality. Was it possible, he wondered, that these virtuosos had achieved their remarkable state of productivity by flouting a particular physiological rule?

"Our best guess is that the same process that provides rapid movement, up to ten times per minute, is also the process that results in dystonia," Hochberg says, adding that a focal dystonia is not caused by nerve entrapment or damage to the tendon or joints.

Hochberg treated his first few hundred musician patients as part of a clinical team because "no one had any idea what was going on." The team included an orthopedic surgeon, a physical therapist, a psychiatrist, and a rheumatologist. But the group disbanded several years ago.

"The psychiatrist left first, saying, 'These aren't crazy people,'" Hochberg explains. "Then the rheumatologist said, 'These people don't have rheumatological problems.'" And by that point, Hochberg and the physical therapist had taught each other what they needed to know to work independently.

Robert Leffert, the orthopedic surgeon on the clinical team, also sought a

RINGS ON HER FINGERS:
As part of her treatment at Brigham and Women's Hospital, flutist Marie Fukuda uses special rings to stabilize the joints of her fingers.

concrete explanation for the dystonias, which were felling world class musicians. Leon Fleisher, for example, considered one of the greatest living pianists in the world, stopped performing because of a focal dystonia. He went to see Leffert at Massachusetts General Hospital.

"He had a constant uncontrolled motion," Leffert explains. "His tendons had become so inflamed that they put pressure on the median nerve at the wrist, and he developed carpal tunnel syndrome. He lost sensation in the thumb, index, and middle finger of his right hand."

Leffert operated on Fleisher in 1981 to correct the carpal tunnel syndrome, but he could not determine the cause



hand injury prevented Schumann from pursuing a wrote about his “numb finger.” Within a few years, his

of the focal dystonia. “After the operation, his hand was quiet for the first time in years, so we started physical therapy,” Leffert says. “Using both hands, he gave a piano performance with the Baltimore Symphony Orchestra that was televised around the world. His right hand was still not normal, and only the fact that he’s such a magnificent pianist got him through it.” But Fleisher was not cured. He was forced to turn to piano concertos written for the left hand.

Focal dystonias are not a new problem for pianists. In the 1830s, a hand injury prevented another promising young pianist, Robert Schumann, from pursuing a career as a keyboard virtuoso. When he was 20 years old, Schumann wrote a diary entry about his “numb finger.” Within a few years, his injury ended his career as a pianist, and he turned to composing.

Hochberg is fascinated by Schumann’s injury. “It’s still undiagnosed,” he says. “It may have been caused by some sort of depressive disorder, or it may have been syphilis. He became concerned about the ring finger of his right hand, so he devised a pulley he called the Cigar Box, which elevated his finger above the keyboard and gave it independent function.”

Selective Movements

About two-thirds of Hochberg’s musician patients present not with dystonias but with overuse injuries. “They have a localized inflammation of the joint or tendon, probably due to microscopic tears of the tendon with hemorrhaging,” he says. “Almost invariably, the problem is related to the shoulder. Your arm weighs between 15 and 20 pounds, and even

though playing an instrument tends to involve selective movements of the fingers and wrists, your shoulder musculature takes most of the brunt of the movement. Most people can’t stabilize their shoulder while using their fingers.” He recommends physical therapy and exercise to return a normal range of movement and to strengthen the muscles needed to stabilize the shoulder. “Playing an instrument is not good exercise,” he says. “You would think the more you play, the stronger your arm would get, but that’s not true.”

Of the thousands of patients Hochberg has seen, fewer than 30 have undergone surgery, most commonly for carpal tunnel syndrome and ulnar nerve entrapments. On average, Hochberg says, patients take three months to recover. During that time, they may only play for ten to fifteen minutes at a time, two to three times a day.

“It’s exceedingly hard for them,” he says. “Younger people see their colleagues passing them by. For older people, it means canceling performances and sometimes being held financially responsible for those cancellations.”

Getting Adjusted

Michael Charness—director of the performing arts clinic at Brigham and Women’s Hospital and a member of the Charness Family Quintet with his wife and three children—has a unique take on what it means to be a pianist with an injury.

“I started treating musicians because of my own injury,” he says. “I was starting to play some difficult pieces. The more I practiced, the more my fingers weren’t doing what

they should. They were sluggish, less accurate, and less controlled. I had an electromyogram, which was normal. I had a fairly normal hand exam too, but I felt I had an enormous problem.”

Eventually, Charness underwent surgery to decompress his ulnar nerve on both sides. That was in 1984, and he slowly regained his strength and facility. “It was both frustrating and fascinating,” he says. “I had a debilitating problem, yet my hand appeared normal to skilled clinicians.”

Charness sees focal dystonias as particularly vexing. “It’s a bizarre disorder,” he says. “People who have spent many years acquiring musical skills lose the ability to perform because their hands pull into a position that makes it impossible for them to play. Their ring finger, for example, may pull into their palm when they play a scale going up but not going down. For others it’s a more general degradation, although outside the context of playing an instrument, their hand appears normal.”

When Charness meets with patients, he watches them play their instruments. “We’ve learned how to change people’s position to make it easier to sustain playing,” he says. “For example, it’s common to see violinists with pain in their left shoulder or neck. One of the first things I do is adjust the way they set up their instruments so they don’t bring up their shoulders.”

Violinist Ruth Winters began noticing a problem last summer. She couldn’t play because of pain tingling down both arms from her shoulders. Charness examined the way she held the violin and told her to get fitted with a new shoulder rest, so she wouldn’t have to crank her head down to hold the violin, and a new chin rest to accommodate her long

career as a keyboard virtuoso. When he was 20 years old, he injury ended his career as a pianist, and he turned to composing.

neck. He also sent her to a physical therapist.

"The therapist started working on my tendons," Winters says. "Apparently they had tightened, and my shoulders were too far forward." She did strengthening exercises. "I feel phenomenal now," she says. "I recently performed Vivaldi's Concerto in A Minor for violin. Even though I'm playing a lot, I'm being much more sensible."

Other instruments also can cause problems for musicians. The English horn, Charness points out, is a heavy instrument whose weight is borne on the player's right thumb. "A patient came to me with a problem in her right arm," he says. "She had an ulnar nerve entrapment. We got hold of a circular clamp that fits around the bell of the English horn and transfers the weight of the instrument from the right hand to the floor, like the endpin of a cello. She was able to play her tour and recover as she did so."

If double-jointed players have lax joints, Charness fits their fingers with stabilizing rings. Only rarely does he prescribe medication, and then it may be an anti-inflammatory for pain or a betablocker for performance anxiety. But for the common overuse injuries, rest and physical therapy are often the most effective treatments.

That is sometimes easier said than done. "Many work mind-boggling

hours," Charness says. "I had one cellist who practiced 15 hours a day and who told me that all he did was eat, sleep, and play the cello."

How much practice is too much? "That's a difficult question," Charness says. "I think most people ought to be able to get everything done in four to five hours or less. It has to be individualized, but there are some general principles that encompass, for example, not

playing for more than 25 minutes without a break."

Musicians and Physicians

Fortunately, such single-mindedness can often be turned to healthy ends. When world-class musicians focus their phenomenal talent and drive on the reorchestration of their bodies and techniques, Hochberg says, "their compliance is fantastic. Indeed, they become the single most motivated group of patients I've ever had."

The admiration between doctors and musicians is mutual, perhaps because the two disciplines have so many similarities. Musicians and surgeons, for example, have analogous skills, says Leffert. "Both music and medicine require a great deal of discipline, much dedication, and long hours of study. They need more than casual control and coordination of your hands. And they both require artistry."

"There's a historical connection between music and medicine," Charness adds. "Hordes of physicians are also musicians. I once did a four-hands piano piece with a fellow who had soloed with the Philadelphia Orchestra when he was 12. He realized there weren't many jobs for pianists and so became a physician instead." ■

Phyllis L. Fogell is associate editor of the Harvard Medical Alumni Bulletin.



ROBERT LEFFERT likens world-class musicians to high-grade athletes: "They're very talented and directed people," he says. He also draws parallels between music and medicine. Both, he says, require discipline, dedication, and artistry.

Health through



Outreach workers in Benin and
Guatemala use lyrics to promote health

by MATTHEW DAVIS

MUSIC PERMEATES OUR DAILY LIVES. It graces our weddings and funerals, fills our elevators and waiting rooms, and accents the messages advertisers want us to hear. It can be incidental or inspirational, sensitive or severe, humorous or horrifying. Amid all this remarkable variation, the fundamental intent of the music in our lives never changes: music is communication, intended to carry a message and to influence our responses to that message.

There can be no doubt that music accomplishes these twin goals. For centuries, civilizations have used music to convey needs, wishes, demands, and ideas. But in the past few decades, some have wondered

whether the messages in music—specifically, popular music—actually have too much power to influence and possibly even injure people, particularly children. In the 1980s, Congress held hearings with concerned parents that led to warning labels on record albums with explicit lyrics. Following the shooting deaths in a Colorado high school this past spring, government officials openly questioned whether particular forms of music had provoked the tragic actions of the teenage assailants.

As a musician, I have been sensitive to these sharp attacks on music. I didn't want to agree that some types of music might affect people so adversely. I wanted to believe that a preference for particular types of music was a marker for antisocial behavior—not its cause. Yet I know

well the communicative power of music. What has frustrated me is that today's concerns about the effects of popular music focus exclusively upon the negative impact. I have focused instead on music's positive potential, particularly the role it can play in improving health through preventive interventions.

From Therapy to Prevention

Since the beginning of recorded time—and likely before, since songs may have been the principal means of preserving personal stories and community histories prior to the written word—humans have used music to help heal the sick and troubled. For the ancient Greeks, a single god, Apollo, had dominion over both music and health. Native American shamans played music as



they delivered their incantations and therapies. And for Renaissance physicians, a knowledge of music was indispensable to producing medications with the right mixture of “hot” and “cold” ingredients, and to judging the pulse of any patient.

During the past century, music has played a formal role in Western medicine’s healing efforts. In fact, although it remains controversial, music therapy has gained enough prominence and empirical support—especially in therapy for chronic diseases or for particularly painful illnesses—that its proponents argue that it should be a covered benefit of health insurance.

Comparatively little is known about how music might be used in preventive, rather than therapeutic, health interventions. The few published evaluations of music-based

preventive programs have focused on a variety of public health initiatives that have included songs with specific messages.

“Message songs” have served as elements of successful, multimodal interventions, such as prenatal care promotion efforts in Mexico and water hygiene education programs in Bolivia. To my knowledge, though, no one has tried to measure the precise impact of message songs in isolation from other health promotion techniques in order to determine how well songs can communicate information and change people’s behavior.

Why should we care about the efficacy of message songs? First, health care providers and public health officials do not yet have consistently effective ways to encourage healthy behaviors. Meanwhile,

advertisers bombard us with message-songs that convince us to eat, drink, and use many products that are harmful to our health. Is it possible to turn the tables and use music just as effectively to promote healthy behaviors?

Second, public health campaigns that rely upon print media fail to communicate with illiterate people and are often written at an above-average reading level. In contrast, songs offer a mode of communication that does not depend upon literacy and can be easily adapted to appeal to audiences with a range of language and cultural backgrounds.

Benin Sings a New Tune

Convinced of the potential for effective message-songs about health, I

GANSIN, a village singer in Benin, spreads messages about health through song (opposite page). Above, the author (holding the saxophone) participates in a community jam session.

*I*t was clear from the reactions of the villagers who the crowd loved his performances whether he sang

went in search of individuals and communities who were already using music for this purpose. I was aware that the international health community had experimented with modes of communication that did not rely upon the written word. Therefore, during my second year at HMS, with the support of a Paul Dudley White Scholarship, I traveled to the West African country of Benin, a part of the world renowned for its vivid musical tradition.

In Benin, I met a community nurse and a village singer who, despite living hundreds of miles apart and speaking entirely different languages, had reached the same conclusion: singing about health can inspire people to change their behavior. Yerima, the nurse, told me that he started to sing

about health issues out of frustration. He had noticed that the women who came to his village's two-room health center for prenatal care paid little attention to his lectures on topics such as nutrition and childhood vaccinations. Yet when he composed and performed songs with the same information, he found that his audience became much more interested, and they sang with him in the common call-and-response form of the region.

Given the threat of a cholera epidemic at the time of my visit, I asked whether he could write a new song to communicate fundamental ideas about water hygiene. Yerima disappeared into the back room while the clinic director gave a lecture on cholera, which received scant attention. Five minutes

later, Yerima returned and began to shout that cholera causes diarrhea. The crowd responded with sounds of disgust. Yerima then began to sing, repeating a response line for them: *kolera baradarorwa* (cholera will kill you). Gradually, he began to sing lines of information between the response lines, advising the women to boil their water and urging them to wash their hands and those of their children before eating. In less than ten minutes, a new song had been learned and a new message communicated: simple, fast, effective, memorable.

By listening to a recording I made of Yerima's performance, a woman in another village learned the cholera song and taught it to other women at her local health center. Yerima and his song had demonstrated the appeal, adaptability, and accessibility of musical health messages.

The village singer I met, Gansin, sang message songs to highlight the importance of health issues in his community. Gansin, who had followed in his father's footsteps as the village singer, had been entrusted by his community with the responsibility of preserving the history and life lessons of the village ancestors. But in his 19 years of singing, he had also composed several new songs about such health issues as vaccinations, nutrition, and family relationships. He had even composed a song about oral rehydration therapy—including the recipe!—to sing when diarrheal illnesses were common in the village.

I was struck by Gansin's obvious commitment, as a musician, to spreading messages about health. In a sense, he was simply fulfilling his obligations as a community resource. But it was also clear from the reactions of the villagers who gathered



BYE-BYE WORM: Schoolchildren in Guatemala sing "Adiós, lombriz," a song that promotes personal hygiene.

gathered every time he played that he was an entertainer; about watery diarrhea or the beautiful harvest moon.

every time he played that he was an entertainer; the crowd loved his performances whether he sang about watery diarrhea or the beautiful harvest moon. I asked him why, when he could sing about anything at all, he sang about health. "Because without health we cannot sing, we cannot dance, we cannot live," Gansin replied. "Health is essential."

The Power of Musical Messages

Inspired by Yerima and Gansin, in 1993 I traveled to Guatemala to conduct a study of message-songs among schoolchildren. While I was there, I also worked in rural village health centers alongside Guatemalan medical students, a role that enabled me to collaborate with local schoolteachers and school directors. Together with the teachers, I developed a curriculum about what they agreed was a major health priority for children—personal hygiene to prevent intestinal parasitic infections.

To determine the children's knowledge about parasitic infections and their personal hygiene practices, I prepared a written survey in both Spanish and Cakchiquel, the local Mayan language. Working with schools in three separate villages, I administered the survey to nearly 150 third-grade children, who had been able to read and write Spanish as a condition of entry to that grade level. Then I randomized one of the schools to the message song intervention, while the other two schools received the standard education. In hour-long, weekly sessions for one month, I provided students with brief didactic lessons and led class discussion in Spanish on the learning objectives, followed by a question-and answer



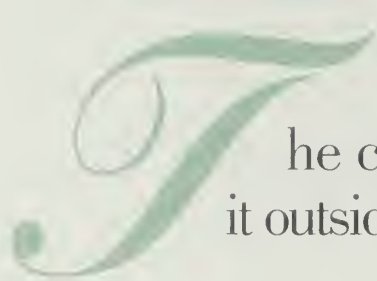
A COMMON REFRAIN: The author plays a soprano saxophone as part of a community jam session in Benin. Back in the United States, he continues to try to demonstrate the preventive potential of "message-songs."

game that emphasized the points already introduced.

I then taught one group a song that conveyed the same information as the question-and-answer game. I wanted the song to be based upon a melody already familiar to the children, to ensure that they were neither confused nor discouraged by an unfa-

miliar or unattractive melody. The melody that the schoolteachers suggested I use was that of "Frère Jacques."

Each verse of the song was eight lines long, and the fifth and sixth lines changed with each verse to convey a different learning goal. There were nine verses in all, which I introduced gradually over the course of the



he children in the message-song group seemed it outside of school. They would even sing verses to me

month-long intervention. Here is the first verse, in the original Spanish and then an English translation:

<i>No queremos</i>	<i>We don't want</i>
<i>Las lombrices</i>	<i>The worms</i>
<i>Que debe hacer,</i>	<i>What should one do,</i>
<i>Para no tener?</i>	<i>To not have them?</i>
<i>Lavese las manos</i>	<i>Wash your hands</i>
<i>Antes de comer.</i>	<i>Before you eat.</i>
<i>Adiós, lombriz.</i>	<i>Bye bye, worm.</i>
<i>¡Estoy sano!</i>	<i>I'm healthy!</i>

Judging from the eager, laughing responses of all the children involved in the study, they enjoyed the question-and-answer game. But the children in the message-song group seemed especially to enjoy singing the song, and I heard them singing it outside of school. They would even sing verses to me as I walked through the village on my way to the health center.

Measuring Success

The initial appeal of such anecdotal evidence is that it plays to one's hopes and preconceptions about a particular intervention. After all, one finds what one is seeking. The reality of my more objective survey results was not as clear-cut, however. Through a series of three surveys—given immediately before the intervention, one week after the last instructional session, and one month after the last instructional session—I was able to track each child's knowledge and self-reported behaviors over the course of the study. I ran into two main problems, however: The children were knowledgeable and well behaved at the time of the first survey, which did not leave much room to measure improvement. Only if there had been a very large difference between the two groups would I have

been able to detect it using the number of children enrolled in my study.

As a result, the findings from my study of Guatemalan schoolchildren were suggestive, but ultimately inconclusive. Overall, students who sang the song seemed more likely to improve their knowledge and behavior as they learned the verses, but were just as likely to forget what they learned as time passed. Although I was disappointed that my field research had lacked the statistical power to find differences between the groups, I remained convinced that there would be a difference to find.

Now at the University of Chicago, I am continuing to try to demonstrate the preventive potential of musical health messages. Part of my work includes collaboration with the Music/Theatre Workshop (MTW), a Chicago-based community organization that performs musical dramas for preteens and adolescents in local schools. The dramas seek to raise awareness about problems such as drug use, teen pregnancy, and violence, and to provide a forum in which young people can discuss their responses to peer and family pressures. We are currently evaluating the impact of an MTW show on inner city schoolchildren's rates of substance use.

MTW staff members use songs to reinforce the principal messages of the drama, rather than just using one medium or the other, because they believe that songs emphasize particular points but cannot communicate complex messages as well as drama can. Songs can be sung again and again, anywhere, by individuals or groups. If drama is needed to convey elements of the message, then it may be more difficult for the audience

to carry messages away from the performance. Decreased portability may translate into decreased effectiveness.

Medicinal Music of Tomorrow

Many questions remain about the utility of message-songs as a mode of health promotion. To answer such questions will require well-funded research that permits large, controlled field trials with rigorous evaluation components. Funding opportunities for such studies may not be widely available. Yet sometimes the potential for applications drives sponsorship of research in a particular field. I can imagine a variety of ways in which musical messages might influence our health in the future.

One opportunity for musical intervention, for example, might be in the area of non-compliance with outpatient medications, a major reason why people do not enjoy improved health once drugs have been prescribed. Today, microprocessors allow us to set wristwatches with routine alarms to remind patients of appropriate dosing intervals. In the future, a more melodious musical reminder might be installed in a wristwatch or a patient's daily dosing box. Patients might even select their favorite melodies from an available assortment. If this technology proved effective, pharmaceutical companies would jump at the chance to underwrite such reminders, since non-compliance erodes their customer base.

Television might provide other opportunities for message-song delivery. Today, public service messages promoting healthy behaviors are often relegated to late-night broadcasts, when advertising time is inexpensive, but the audience is small. Recording artists

especially to enjoy singing the song, and I heard them singing as I walked through the village on my way to the health center.

THE ROAD AHEAD:
A woman walks on
the outskirts of a
village in Guatemala,
where physician
Matthew Davis taught
children a song about
protecting themselves
against intestinal
parasitic infections,
sung to the tune of
"Frère Jacques."

often deliver such public service messages, but only as spoken testimonials, not through their artistic mediums.

In the future, popular musicians might follow the lead of performers such as Gansin in Benin and sing health promotion songs as part of their repertoire. Music videos for these songs might be broadcast during advertising slots in prime time hours. Television stations could promote the videos in advance, and then use them to draw viewers to watch their programs. Stations, which would reap the benefits of additional viewers, might be persuaded to underwrite the video production. The artists, in turn, would seek the exposure these video broadcasts would offer, as well as the good will engendered by their health promotion efforts.

Will these scenarios of musical health messages come to pass? I think they are not only possible, but likely. As I listened to Yerima and Gansin in Benin, and to the schoolchildren in Guatemala, I saw how effective health promotion through music could be. I dreamed of seeing that sort of public health success in schools and communities around the world. And why not? All it takes is a song. ■

Matthew Davis '94 is a Robert Wood Johnson Clinical Scholar at the University of Chicago.



Medical

HMS alumni compose lives that
balance music and medicine

by BEVERLY BALLARO & DEBRA MALINA



Richard Kogan

'81

WHEN RICHARD KOGAN ARRIVED AT HMS, he was already an accomplished musician, and he knew he could not give up the piano for the duration of his medical training. He credits Dean for Medical Education

Daniel Federman with enabling him to juggle music and medicine. Federman created a special five-year schedule for him, including time off for performing concerts between rotations. And even when he was on-site at the medical school, Kogan continued to perform in a trio with two of his Harvard College classmates, violinist Lynn Chang and cellist Yo-Yo Ma.

Today, Kogan continues to balance music and medicine. He is a concert pianist, a practicing psychiatrist, and the acting director of the Human Sexuality Program at New York Presbyterian Hospital-Cornell Medical Center. As a specialist in sexual dysfunction, Kogan seeks to help patients express themselves emotionally, realize their potential, and experience life to the fullest. He thus focuses on the achievement of "peak experiences," a description that he would apply to music as well as to sexuality. Recently, he has been

pondering the connections between the two in preparation for a lecture series about how the sexual practices of great composers relate to the characteristics of the music they have written.

Such studies extend one kind of work Kogan has been doing for some time. Fascinated by the way in which many composers managed to sublimate or channel their suffering and convert it into creativity, the psychiatrist-pianist lectures on such artists as Beethoven, Gershwin, and Schumann, illustrating his points with music.

"Beethoven," says Kogan, "transcended his deafness by withdrawing into the world of his imagination and reaching a stylistic breakthrough. Schumann was truly mentally ill, with manic-depressive psychosis. He used his auditory hallucinations, the voices, to create. I seek to explore such links between psychopathology and creativity."



Samuel Wong

'88

Kogan also manages to combine his two driving interests by playing concerts to raise money for health-related organizations, such as the American Cancer Society, the National Multiple Sclerosis Society, and Music for Healing.

Despite such connections—and despite the similarities he draws between music and medicine, calling them both “healing arts”—Kogan finds that he thrives on piano performance and psychiatry for different reasons. He says there is nothing in music quite like the intellectual fulfillment he finds in the one-on-one, doctor/patient relationship. Nor does psychiatry offer any equivalent of the artistic satisfaction in performing a Brahms concerto. So in his own life, Kogan continues to require the kind of schedule Dean Federman worked out for him, one that balances two kinds of peak experience.

—Beverly Ballaro

AT HMS, SAMUEL WONG FELT PRESSURE TO align himself with the hard science of genes and molecules. It was only after he had decided to leave his work in ophthalmological surgery for a career as a conductor, Wong says, that he gained the courage and wisdom to recognize that although healing through music “is not as quantifiable or easily expressible in words, it’s just as powerful a realm as traditional Western medicine.” That music can open new therapeutic frontiers is “more than just a hunch,” says Wong. “Many studies are showing the efficacy of musical interventions in health care.”

When he was a medical student, Wong’s mind and heart were torn between medicine and music. The struggle came to a head in 1990, when, in a single day, the young resident at the Manhattan Eye, Ear, and Throat Hospital performed surgery on two brothers in the morning and conducted the New York Philharmonic in the evening. Although all three performances were successful, “I couldn’t continue like that,” Wong says.

At HMS, Wong was hard pressed to see the symbiosis between his two chosen fields—“I just followed my heart,” he says. But in retrospect, the

maestro recognizes that the sciences and music “inform and cross-fertilize each other.”

Wong draws similarities between conducting an orchestra and performing surgery, beginning with the striking fact that the latter takes place in a venue called an “operating theater,” complete with bright lights. He waxes poetic about the symbolic reduction of both the masked, gowned surgeon and the silent conductor to mere, but all-powerful, eyes and hands.

Wong now serves as music director of both the Hong Kong Philharmonic and the Honolulu Symphony and guest conducts in Japan, Europe, and such cities as Houston, Seattle, Montreal, and Toronto. Yet he also finds time to bring healing music to patients with neurological disorders.

Wong has touched patients who have appeared beyond reach, as well as audiences of many cultures, and he has come to understand that music and medicine both address the human condition and unite people. For those armed with such universals, concludes Wong, “home is wherever art and science reside.”

—Debra Malina

Henry Schniewind, Jr.

'65

LIKE MANY DOCTORS, HENRY Schniewind, Jr. carries his business cards with him. Unlike many, he dispenses two types: one in sober beige advertising his psychiatry credentials; the other, emblazoned with the image of a keyboard, promoting his skills in piano standards and jazz. Schniewind, a psychiatrist in private practice, has spent many hours over the past year in a different kind of practice—as a jazz performance major at Boston's Berklee College of Music.

Although Schniewind had discovered at age ten that he had a knack for playing music by ear, he had never learned how to read music properly. Nor had his lack of training bothered him, until, in 1991, he joined a jazz ensemble group in Brookline. The technical gaps in his playing became apparent, so he apprenticed himself to a piano performer.

The psychiatrist soon landed a Sunday night gig at Boston's Club Cafe, an experience that left him nervous but hooked. He played there for the next year and a half, occasionally encountering patients who, once they

had recovered from the surprise, generally reacted positively to their doctor's alter ego.

Schniewind's steady gig expanded his repertoire, his skills, his confidence—and his awareness of his lack of formal training. So he applied to Berklee, becoming the oldest in a class of 700 students.

Schniewind realizes that his decision to divide his energy between music and medicine at this stage in his life might raise eyebrows among some of his colleagues. Yet he believes psychiatry and jazz are not such dissimilar realms. Both provide means by which people engage in powerful, cathartic, and often poetic expression.

He imagines that his two disciplines will continue to overlap as he pursues his goals of performing solo, working with singers, and teaching music. Balancing 20 to 25 hours of psychiatric practice with a full complement of music courses is certainly demanding, but he finds the challenge energizing. "If you're going to die from something," he muses, "it should be life, and music is life."

—Beverly Ballaro



Yeou-Cheng Ma

'77

AS THE DAUGHTER OF AN OPERA SINGER and a musician who played 200 instruments, Yeou-Cheng Ma never questioned that she would be involved with music. She got her first violin at seven months, began playing at two-and-a-half, and from then on, music was always "what I do for fun," she says. But if music came naturally to Ma, another natural tendency might have hindered the dual calling that landed her as a developmental pediatrician at the Albert Einstein College of Medicine and as executive director of the Children's Orchestra Society in New York: Ma was shy.

Her shyness contributed to her decision not to become a professional performer. She ceded that role to her more outgoing younger brother, cellist Yo-Yo Ma, who had earlier opted to avoid sibling rivalry by leaving violin playing to his sister. Instead, Yeou-Cheng studied the sciences at Harvard and went on to HMS despite her trepidation about the interpersonal challenges of practicing medicine. Unexpectedly, she found great comfort in taking care of people—and in helping adults to see that children "come in different sizes and ways of thinking."



In childhood, Ma's shyness was exacerbated by her family's immigration to the United States. "When I first came to America, I knew little English," she says. "In a certain way, I was like a language-disordered child." She feels a special affinity for many of the developmentally disabled children with whom she works, and she uses music to reach them. "Many children who are unable to use language enjoy music. You can use music to calm them while you're doing procedures, or to reach out to them in a nonverbal way."

If music feeds her pediatric work, the exchange is two-way. Ma says that when she teaches music, she uses the tools she has developed in working with challenged children. "I have many students that other teachers might have been too discouraged to teach."

Ma also sees general applications for music education. As education specialists begin to understand better the different modes of learning—visual, auditory, kinesthetic—many recommend multimodal learning. Music, says Ma, is one way of doing that. Music's patterns also make learning it similar to studying science. "But the art of medicine is what appeals to me," she says, "the art of taking care of people—when, for example, to break news to parents that they might not be ready to hear." As in music, she says, it's all a matter of timing.

—Debra Malina

Einar Anderson

'68

EINAR ANDERSON THRIVES ON CHALLENGE. As an active practitioner of emergency medicine affiliated with three hospitals in and around Columbia, South Carolina, Anderson often spends days on end at a hospital 75 miles from home. Yet he somehow manages to find the time to perform as a horn player with the Palmetto Brass and to serve as music director of the Lutheran Bach Choir and Orchestra of South Carolina.

As Anderson sees it, emergency medicine has two key advantages over other specialties. First, as long as the hospital is not short-staffed, ER physicians work circumscribed shifts, allowing for the flexibility necessary to schedule other activities. "If I have a concert or musical function, I simply take that day off," Anderson says.

Second, and more important, the ER offers a tremendous range of intellectual challenges. "A classmate once said that he hated the ER because he never knew what was going to roll through the door," Anderson recalls. "That's why I like the ER—nothing is the same. Every day is different; every case is different."

In a sense, it was Anderson's hankering for intellectual variety that led him from singing and brass performance to conducting. When he was part of an orchestra, a choir, or an ensemble, he found himself intrigued by listening to what the other performers were doing—and seeing what the director did to correct or help them. Anderson did some conducting in high school, and after he had completed medical school and fulfilled his military obligations, he

earned a master's degree in orchestral conducting at the University of Southern California.

The challenges of HMS were heightened by Anderson's participation in the Harvard-Radcliffe Orchestra, an activity that took two nights each week away from his studies. "In medical school, you feel that," he says. "You notice if you're studying that much less than your classmates."

But when he was accepted into the highly selective orchestral conducting program at USC, he learned what real competition was like. As one of only four graduate students, Anderson quickly realized "how

high the professional standards were, and how good some of the people were."

If the intellectual challenge attracted him, however, Anderson has found true satisfaction in the fact that both music and medicine rely on other human faculties as well. In both, he explains, "there's a huge body of knowledge you must have



and certain skills you must possess. But when it comes time to carry them out—to practice medicine, perform on an instrument, or conduct a work of music—then the intellectual aspect is sometimes not as important. It becomes more emotional and subjective. Both professions balance the two sides of human nature nicely."

Both music and medicine, Anderson adds, have healing properties. "The ultimate purpose of medicine is to improve the quality and duration of life. And music, simply, has very emotional, spiritual, and therapeutic aspects."

—Debra Malina

Smooth operator

From Beethoven to Barenaked Ladies, a survey of the musical preferences of alumni in the O.R.

Carolyn Aldredge '64

Staff Anesthesiologist
Mount Auburn Hospital
Cambridge, Massachusetts

“At my hospital, classical music tends to predominate, although the gynecologists seem to like soft rock. One surgeon likes to play the Grateful Dead during operations in the middle of the night; the best I can say about that music is that it helps keep me awake. I think music in the O.R. should be soothing. My taste runs to classical pieces by Mozart and Haydn, as well as operas by Verdi, Bizet, Mozart, and Rossini. My favorite operas range from Mozart's *Don*

Giovanni, to Dvořák's *Rusalka*, to many of Verdi's operas—*Aida*, *La Traviata*, and *Rigoletto* are all solid beauty throughout.”

Christopher C. Baker '74

Head of the Trauma Section
Department of Surgery, University of
North Carolina at Chapel Hill

“I play relaxing music for patients undergoing local anesthesia, and I allow them to choose the music, hoping they won't pick country. When patients are anesthetized in the main O.R., we tend to have no background music for the tense parts of the case, classical music for periods of concentration, and rock-and-roll for open-





ing and closing. Since I am occasionally sleep-deprived as a trauma surgeon, I will sometimes use the music to quiz medical students and residents about rock-and-roll trivia. I once had to reassure a student that this wouldn't affect her grade."

Edward Chen '89

*Assistant in Anesthesia
Massachusetts General Hospital
Boston, Massachusetts*

"I was trained in classical violin and percussion, spent many seasons with the Harvard-Radcliffe Orchestra and the Boston Philharmonic, and have played in music festivals in Austria and Italy for the past nine summers. Despite my love of music, I find it distracting in the operating room. Anesthesiologists are trained to filter out conversation and alarms and focus on the patient. I have often compared anesthesiologists with percussionists. Casual observers may think both seem idle and clueless, but actually they're aware of what everyone else is doing. Moreover, when things go well, no one pays attention, but when a mistake occurs, everyone notices."

"I took an informal survey among the cardiac surgeons with whom I work. Gus Vlahakes '75 listens to Barry White and old jazz and blues. Cary Akins '70 listens to light rock, but prefers silence during the onset and termination of cardiopulmonary bypass. Ralph De La Torre '92, anesthesiologist Greg Koski '75, and David Torehiana '81 (who usually likes 1970s rock music) all give a thumbs up for Fatboy Slim, a techno-rock group. Other surgeons claim that Fatboy Slim helps them operate faster. In this day of cost-cutting and operational efficiency, every bit helps."

Atul Gawande '94

*Surgical Resident
Brigham and Women's Hospital
Boston, Massachusetts*

"I'm a resident. I listen to whatever the attendings damn well want. Actually, that's not quite true. It's whatever the attendings want but the nurses don't veto. One time I got to pick, though. I brought in Violent Femmes. Bad move. It lasted about three minutes before someone switched it. No one has let me pick since."

John M. Head '50

*Professor of Surgery Emeritus
Dartmouth Medical School
Hanover, New Hampshire*

"I'm not particularly fond of music in the O.R., but if there is music, I prefer it to be classical—especially the symphonies of Beethoven and Brahms—and reasonably sedate. There's a rhythm to operating, and it shouldn't be broken by anything that has a different rhythm."

Cedric Kavena '84

*Staff General Surgeon
Phoenix Indian Medical Center
Phoenix, Arizona*

"I like to listen to everything from Vivaldi to the Rolling Stones. I enjoy the Beatles, Dire Straits, old country tunes—anything with a good tempo. (If you play the slower Baroque music, you can get bogged down.) I also enjoy Mozart and, depending on how bold I'm feeling, Beethoven. During induction of the patient, we surgeons defer to the anesthesiologists, and when things get exciting or require concentration, we turn the music down."



“I play relaxing music for patients, and I allow them to choose the music, hoping they won’t pick country.”

When residents are too slow, we may play ‘Dueling Banjos’ to speed them up.”

Susanne Learmonth ‘52

*Retired Anesthesiologist
Veterans Administration Medical Center
White River Junction, Vermont*

“Music and medicine absolutely go together—just not in the operating room. When music was played, I preferred it to be classical.”

Maxine Lee ‘88

*Anesthesiologist, University of
Arkansas Medical Sciences
Little Rock, Arkansas*

“Music can lighten the mood in the O.R., but it

should not be so loud as to be distracting. If music is played, I prefer that it wait until after the patient is asleep and is turned off before the patient wakes up.”

S. Bertrand Litwin ‘59

*Chief of Thoracic and Cardiovascular
Surgery, Children’s Hospital
of Wisconsin, Milwaukee, Wisconsin*

“Music during surgery is not only enjoyable, but also keeps the tension level down. I enjoy Beethoven, Bach, and Brahms for pleasure. The soothing sounds of the Moody Blues, the Mamas and the Papas, Chris Isaak, and Stevie Nicks reduce tension. And when the situation gets tight, my team knows to immediately put on a disc by Yanni or Enya!”

Lyle J. Micheli ‘66

*Director
Division of Sports Medicine
Children’s Hospital
Boston, Massachusetts*

“As attending physician to the Boston Ballet, I like to listen to classical music, especially ballet scores. I also enjoy country music.”

Elliott V. Miller ‘58

*Anaesthetist
Massachusetts General Hospital
Boston, Massachusetts*

“I enjoy classical pieces, such as Orff’s *Carmina Burana*, Vivaldi’s *Four Seasons*, J. S. Bach’s *Fantasy in Fugue* and *Toccata in Fugue*, Fauré’s *Requiem*, Mozart’s *Symphonies Nos. 39 and 41*, and Beethoven’s *Symphonies Nos. 3, 5, 6, 7, and 9*. I’ve noticed that when surgeons get tired as they’re finishing up an operation, the ending of the *William Tell Overture* can keep them galloping along.”

Francis D. Moore, Sr. ‘39

*Moseley Professor of Surgery Emeritus
Harvard Medical School
Boston, Massachusetts*

“My first impulse is to answer ‘absolute quiet.’ The operating room should be a silent place of concentration on the welfare of others, preferably with good air conditioning. I would not object to a few kind words, if not sweet words, from the members of my team, especially my scrub nurse. But I would not like to hear any distractions such as grunts or shifting of the feet by medical students who object to hanging on to a retractor.

"As for music, I do answer 'absolutely none.' If the music is that of Haydn, Mozart, Bach, or Beethoven—or even if it's good modern jazz—it's worth listening to. But I can't do that and operate at the same time. A little Gershwin or Cole Porter might be a bit more acceptable. But why should I listen to some beginner hack his way through *Rhapsody in Blue* when he doesn't even know the proper tempo for the E major slow movement? And as for Cole Porter, few modern musicians understand how to maintain the basic dance rhythm in his wonderful slower pieces.

"Music has been too much a part of my life to try to listen to it with one ear while digging out a liver tumor with both eyes and the other ear. I am reminded of the time Brahms' *Variations on a Theme by Haydn* was being played while David Hume—at that time, a resident at Brigham Hospital—was operating. Hume muttered, 'I wish they'd take that third variation a little slower.'"

Theresa Quinn '92

*Surgical Resident
University of California, San Francisco*

"This is my eighth year of residency, so I'm subjected to whatever music other people want to hear. If I had a choice, I'd listen to mostly classical pieces by Mozart, Beethoven, and Vivaldi, because I think most other works are too distracting. Jazz saxophonist Joshua Redman also is wonderful in the O.R. But even then, in stressful moments, I'll ask that the music be turned off. During closing, when our work becomes more automatic, popular music is fine. We'll listen to anything from Pearl Jam to Natalie Merchant to Barenaked Ladies."

Vincent Reale '68

*Chief of Plastic Surgery
Genesee Hospital
Rochester, New York*

"I like to play the main stays in orchestral and chamber works—you know, the usual guys—Mozart, Mendelssohn, and the 3 B's. I avoid opera, because although I like it, the staff doesn't. Absolutely no rap; oldies but goodies are permitted. Rossini and Sousa are great for closing."

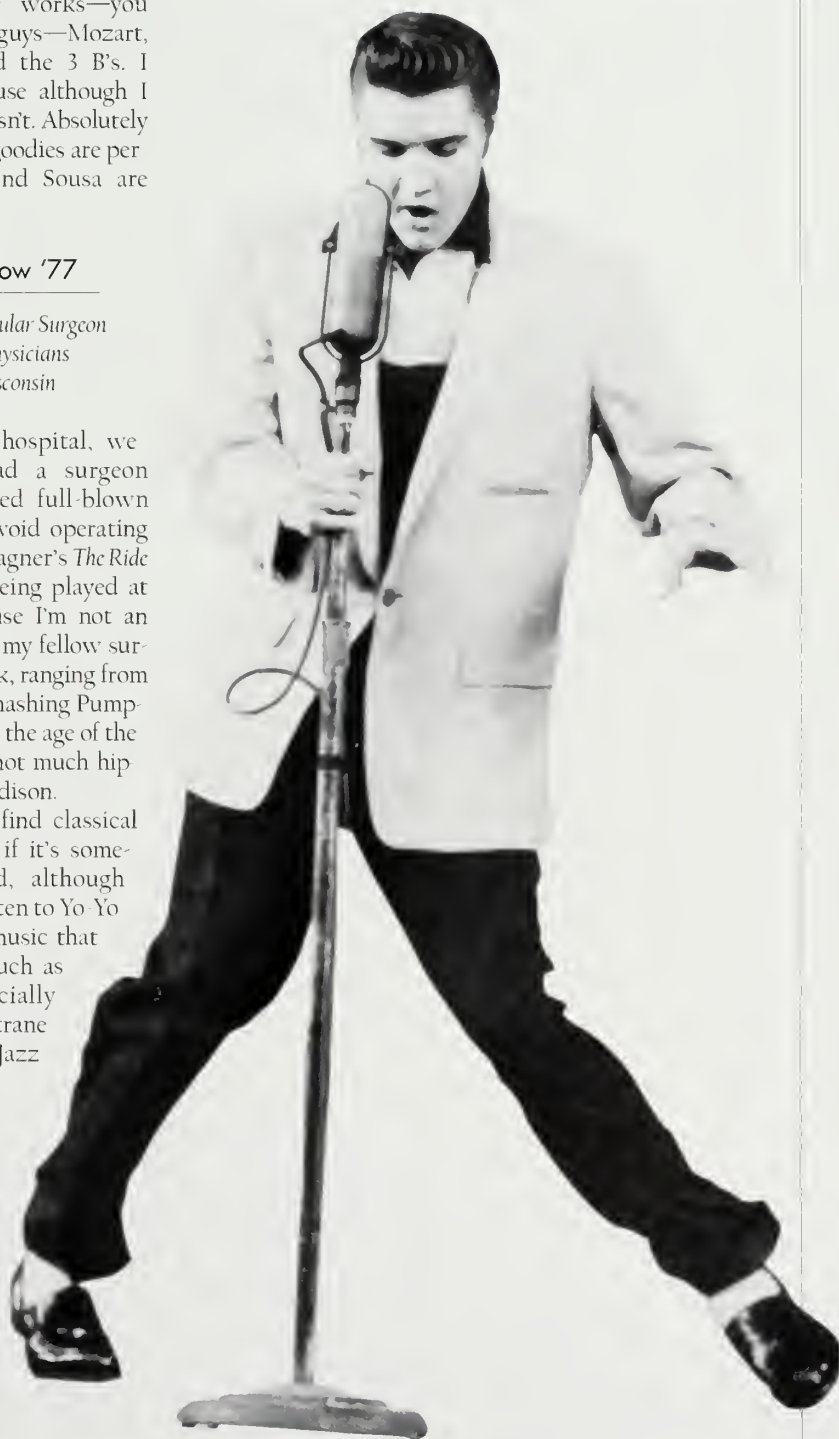
Peter Thurlow '77

*General and Vascular Surgeon
Associated Physicians
Madison, Wisconsin*

"At our hospital, we once had a surgeon who liked full-blown opera; I tend to avoid operating rooms in which Wagner's *The Ride of the Valkyries* is being played at full volume, because I'm not an opera fan. Some of my fellow surgeons also play rock, ranging from Jimi Hendrix to Smashing Pumpkins, depending on the age of the surgeons. There's not much hip hop, but this is Madison.

"As a cellist, I find classical music distracting if it's something I've played, although occasionally I'll listen to Yo-Yo Ma. I prefer soft music that doesn't distract, such as 1950s jazz, especially that of John Coltrane and the Modern Jazz Quartet."

"I will sometimes use the music to quiz medical students and residents about rock-and-roll trivia."



Light Sleepers

HMS researchers have been investigating sleep disorders caused by space travel—and perhaps lending insight into earthbound sleeping problems as well

JOHN GLENN WAS ALL SUITED UP AND INSTALLED on the Friendship 7 early on February 20, 1962, when he noticed that the thermistor attached to his microphone had slipped out of place. NASA officials realized that such a shift would result in faulty data. Rather than try to open Glenn's suit aboard ship, though, they decided simply to ignore all respiratory and temperature transmissions.

We've come a long way since that misty morning, and although the realities of space travel have tamed our wildest dreams, both

monitoring technology and space medicine have evolved—just as the high-definition televisions on which we watch today's launches have long since surpassed the fuzzy, black-and-white dinosaurs that brought Glenn's first historic flight into our living rooms.

When Glenn returned to space on October 29, 1998—this time, appropriately, on a space shuttle named Discovery—the thermistor, now taped to his neck, was supplemented by myriad new high-tech devices.

by DEBRA MALINA



LOST IN SPACE: A space shuttle astronaut navigates through space in a self-contained suit that allows him to float free of the shuttle craft.

Crew members' only downtime usually comes just before of Earth, taking photographs, and gazing out the windows—

Among the arsenal was a supply of Body Core Temperature Monitors—thermometer-radio pills that Glenn had to swallow like vitamins to transmit his body temperature information right from the source.

The pills composed one piece of an elaborate medical technology puzzle designed to investigate the sleep problems caused by space travel—and perhaps to offer insight into earth-bound sleep disorders, which tend to have a disproportionate effect on the planet's older population. The study was led by Charles Czeisler, HMS professor of medicine and chief of the

orbiting Earth wreaks havoc with astronauts' circadian rhythms, since their speed of travel results in 45-minute "days" followed by 45-minute "nights." Moreover, to prepare for landing, bedtime is set 30 to 40 minutes earlier each night—"one of the most effective schedules we have in the laboratory to induce insomnia," notes Czeisler.

In addition, the upright sleeping accommodations are not the most soothing. Even encasing oneself in a sleep sack velcroed to the wall doesn't always eliminate all the annoyances of a weightless body. And despite NASA's careful scheduling to allow for eight

light of one of the numerous daily sunrises. This light exposure, says Czeisler, can undermine whatever resetting the astronauts have been able to do of their circadian pacemakers.

"It was once thought that humans differed from other species in that our circadian pacemakers responded to social interaction rather than light," says Czeisler. "But we have learned that not only are humans sensitive to light, we're exquisitely so: light keeps our internal clocks in sync with the outside world."

It was this discovery that first brought Czeisler and his laboratory to the attention of NASA back in 1990. A space shuttle that was scheduled to launch around midnight, inverting its personnel's sleep-wake cycle, was being repeatedly delayed. A crew member had heard about an article Czeisler had published in the *New England Journal of Medicine* indicating that his laboratory's research could be applied to help shift workers adjust to night work. The astronauts wanted in—and they wanted in fast.

For medical researchers accustomed to methodical experiments, long-term studies, and cautious declarations of success, NASA's scientific culture might come as something of a shock. With so few astronauts to draw on, and so many limits to the replication of outer-space conditions on Earth, NASA fosters a "just-give-it-a-shot" mentality. Not only are astronauts—whose choice of vocation clearly signals a yen for adventure—willing to experiment, but the experience of a single crew member can carry tremendous weight.

So, in December 1990, NASA experimented with Czeisler's light therapy, covering the entire ceiling of the Johnson Space Center's crew quarters with light, and carefully regulating the timing, duration, and intensity of light



RETURN TRIP: John Glenn in 1962 before becoming the first American to orbit Earth (left); Glenn in 1998 before joining the Space Shuttle *Discovery* crew (right).

Circadian, Neuroendocrine, and Sleep Disorders Department at Brigham and Women's Hospital.

As Czeisler explains, the obstacles to getting a good night's sleep in outer space are manifold. First, astronauts must adjust to the sleep-wake cycle dictated by their mission schedule; a shuttle launched in the morning requires the crew to be awake and suited up in the wee, dark hours. Then,

hours of sleep, Czeisler and his colleagues found that crew members on two recent shuttle missions slept only six and a half hours per night—with no chance to catch up on the weekends.

To make matters worse, crew members' only downtime usually comes just before bedtime, so they tend to spend this period making observations of Earth, taking photographs, and gazing out the windows—often at the bright

bedtime, so they tend to spend this period making observations often at the bright light of one of the numerous daily sunrises.

exposure. Although Czeisler's light therapy laboratory in Boston had taken two years to construct, NASA managed to replicate it in a mere eight days.

The sunlight simulation was a great success: mission commander Vance Brand later told Czeisler that he had gotten more done the first night using the new system than he had done in a month of sleepless nights when he was trying to adjust to the night shift by sheer force of will. By the second night, Brand declared that if the much-adored T38 ("the Jaguar of airplanes," says Czeisler) was not ready for his training flight by the scheduled time, he would cancel his eagerly awaited ride so he could make it to light therapy on time.

The crew was so pleased with the results of the therapy that they dubbed Czeisler "Doctor Light" and volunteered to serve as his experimental subjects during their mission. Indeed, the melatonin content of the urine they collected during their trip proved that they had completely shifted to their night schedule. Today, resetting the crew's clocks using the lighting facilities now installed in both the Kennedy and the Johnson Space Centers has become standard operating procedure in the quarantine period before shuttle launches.

But although bright light can work wonders on the circadian pacemaker, other hindrances to space-sleep still exist. Some astronauts have long relied upon sleeping pills to counter these occupational hazards, and, fearing the pills would have deleterious effects on daytime performance, NASA decided to try melatonin, a hormone supplement widely sold in health food stores. Warning that the substance hadn't been fully tested, Czeisler's team offered to work with the space agency to study the effects of melatonin on both sleep and daytime performance.



GETTING WIRED: Before taking his second historic flight, John Glenn spent the night wired to instruments that recorded his brain activity while he slept. Here he tries out the equipment with Harvard physician Charles Czeisler's help.

Although more than 90 percent of crew members take some type of medication while in space, most commonly sleeping pills, notes Czeisler, no double-blind, placebo-controlled trial of any medicine had ever been conducted in space. So when NASA solicited proposals for the Neurolab space shuttle mission scheduled for April 1998, Czeisler proposed a double-blind, placebo-controlled study of melatonin. The study had three goals: first, to compare ground based recordings before and after the flight to recordings in space, in order to find out what happens to sleep up there; second, assuming that sleep would be disturbed in space, to determine whether melatonin would help; and third, to discover how circadian rhythms would be affected.

It was these questions that the thermometer-radio pills were designed to

help answer. Developed as an alternative to the traditional rectal sensor (used, for instance, to monitor body temperature during surgery), the pill sends signals to small, lightweight devices strapped to the astronauts' waists. Yet the receiver required robust, user-friendly software to be practical on a hectic shuttle mission.

Joseph Ronda, instructor in medicine at Brigham and Women's Hospital, stepped in to design the software. "We developed an interface for the temperature pill and recorder that allowed the astronauts to initialize the device with a single keystroke," Ronda says. "It would indicate to them that the recorder was okay, allow them to do a small functional test of the recorder, and then walk them through the process with prompts every step of the way."

NASA used small, sticky biosensors, which were attached biosensors then measured and received signals on brain

Temperature readings, however, are only part of the story. The Neurolab astronauts—and Discovery's John Glenn and Chiaki Mukai after them—found themselves enveloped from head to fingertips in other technological wonders. "We were guinea pigs in space," Neurolab astronaut Richard Linnehan noted at a recent forum of the Harvard-MIT Division of Health Sciences and Technology. The test subjects used a small, ambulatory digital sleep recorder, which, explains Rod Hughes, instructor in medicine at Brigham and Women's Hospital, is "a sleep laboratory in a box, capable of collecting 24 simultaneous channels, including heart rate, oxygen saturation, and different respiration channels such as chest movement and snoring."

A group from MIT—led by Laurence Young, Apollo Program Professor of Astronautics—worked with NASA on the software that enabled the crew to hook themselves up to the digital sleep

recorder. Because it gave the astronauts all the abilities a principal investigator would have, the MIT group dubbed the system the "PI in a Box."

In the laboratory, sleep studies require electrodes to be glued to subjects' heads. In space, this was impossible, so NASA used small, sticky biosensors, which were attached to a sleep net that went over the astronauts' heads. These biosensors then measured and received signals on brain wave activity, eye movement, and chin-muscle activity.

To collect other measurements, the test subjects wore RIP suits (for respiratory inductance plethysmography)—Lyca T-shirts and shorts with sensors and wiring woven into the fabric, designed to measure movement of muscles in the chest and abdominal wall. They also wore fingertip pulse oximetry devices, to monitor the amount of oxygen in the blood; a monitoring device taped to the neck to record breathing sounds and snoring; and

wrist actigraphy devices to measure body movement and allow for the estimation of sleep and wake times.

"It's chaos," Linnehan says of the complexity of the rocketship-turned-laboratory. "Cables and experiments are everywhere. You have to move slowly as you adapt, or you can kick people and become unpopular."

Oddly enough, on the nights when they were required to wire themselves inside and out, the astronauts tended to sleep somewhat longer. "It may be that they felt watched," suggests Derk-Jan Dijk, assistant professor of medicine at Brigham and Women's Hospital. Czeisler offers a similar hypothesis: the technical equipment may have given participants the sense that sleep, too, was important work, allowing them to make sleep their priority.

In addition to ensconcing themselves in equipment, the astronauts kept daily logs about their perceptions of their own sleep. They also underwent a computerized battery of tests on the days after the sleep experiments in order to demonstrate reaction time, visual vigilance, short-term memory, cognitive processing speed, and hand-eye coordination. The biggest problem with sleep deprivation, after all, is the deleterious effects it can have on daytime performance—a debility of supreme importance for airline pilots and shuttle astronauts, whose every move might be a matter of life or death.

Megan Jewett, an HMS instructor in medicine, is now applying herself to this problem of human performance. Jewett has worked with Czeisler and with Richard Kronauer, professor in the Harvard-MIT Division of Health Sciences and Technology, to develop a mathematical model of neurobehavioral performance. By inputting data on light exposure and on waking and sleep times, the model can predict how well



ON THE ROAD TO DISCOVERY: John Glenn and crew members approach the Astrovan that will take them to Launch Pad 39B at the Kennedy Space Center.

to a sleep net that went over the astronauts' heads. These wave activity, eye movement, and chin-muscle activity.

an individual should be able to perform cognitive tasks at any given time. Having such a map laid out in advance, Jewett points out, will enable NASA officials to schedule their crew's shifts and tasks sensibly—and, with current data downloaded during missions, to make schedule changes as necessary.

Jewett has also worked with Emery Brown, an assistant professor of anesthesiology at Massachusetts General Hospital, who has been focusing on the circadian component of this model, elicited in the form of body temperature readings. During the temperature trough humans normally experience in their deepest sleep, performance reaches its lowest level. Predicting when that window will occur will allow schedulers to avoid requiring cognitive acrobatics during the period when they are least possible to achieve. And with live feedback from a space shuttle, NASA can take account of unexpected changes in circadian rhythms and determine whether or when to introduce countermeasures, such as bright light exposure or the elimination or delay of certain tasks.

Czeisler and his colleagues hope that all of this space-based research will translate into a greater understanding of earthbound sleep disorders. They realize, however, that direct translation is impossible. Although the melatonin supplements apparently had no effect either on quality of sleep or on users' performance on the next day's tests, for instance, Dijk warns that it's too early to draw conclusions about melatonin's effectiveness on Earth.

Nor is it clear whether an increase in rapid eye movement (REM) sleep upon astronauts' return to Earth can be attributed to some space-travel-related phenomenon or simply to the jet lag that results from readjustment to their original time zone, which often entails going to sleep during a high-REM propensity circadian phase.



BLAST OFF: Orbiting Earth wreaks havoc with astronauts' circadian rhythms, since their speed of travel results in 45-minute "days" followed by 45-minute "nights."

And at the same time that they seek lessons for the rest of us, both NASA and the Harvard researchers are concerned about the potential for far greater sleep-related hazards on any future mission to Mars. As the leader of the Human Performance Factors, Sleep, and Chronobiology team of the National Space Biomedical Research Institute, Czeisler is now evaluating the minimal light intensity needed to synchronize the circadian pacemaker to a 24-hour day. All light exposure will have to come from artificial sources, since current design plans for a Mars-bound spaceship include no windows. The team is also investigating the best method for adjusting to

the 24.6-hour day travelers will have to live with on Mars—and attempting to determine when, during their six to ten months in their windowless "can," crew members should make the shift.

"It turns out," says Czeisler, "that the length of the Martian day would require us to make quite a physiological adjustment." By the time a Mars mission comes to pass, however, Doctor Light expects to have written the prescription for a smooth transition—if not to the waking reality of an alien planet, at least to the sleep habits necessary to explore it. ■

Debra Malina is a freelance writer based in Cambridge, Massachusetts.

Mission to Mars

by DEBRA MALINA

After eight long months on the spaceship, you've finally landed on Mars. You're settling in for a long wait—the next alignment with Earth won't be for at least another year—when you discover that your new environment is more hostile than you'd anticipated. Will your blood pressure be too low or your muscles too weak for you to escape danger?

Such questions are being explored by a growing number of HMS researchers, who have been finding in the quest for Mars new applications for their research. Collaboration between HMS scientists and NASA received a boost in 1997, with the launching of the National Space Biomedical Research Institute (NSBRI), a consortium of seven research facilities, including the Harvard-MIT Division of Health Sciences and Technology.

With the advent of NSBRI, many of these scientists find they're drawing an unusual and more enthusiastic audience for their work. For instance, Alfred Goldberg, HMS professor of cell biology, has long studied the mechanisms of muscle wasting such as that which occurs in astronauts—often prohibiting them from standing or walking upon their return to Earth—and has established that disuse atrophy is due primarily to accelerated protein degradation. While Goldberg's work is relevant to

such serious systemic diseases as cancer cachexia, sepsis in surgical patients, AIDS, diabetes, and renal failure, the National Institutes of Health and private agencies have not given a high priority to this area. Instead, it is the backing of NSBRI that is now allowing Goldberg's laboratory to expand its research on the molecular mechanisms that cause muscle protein degradation.

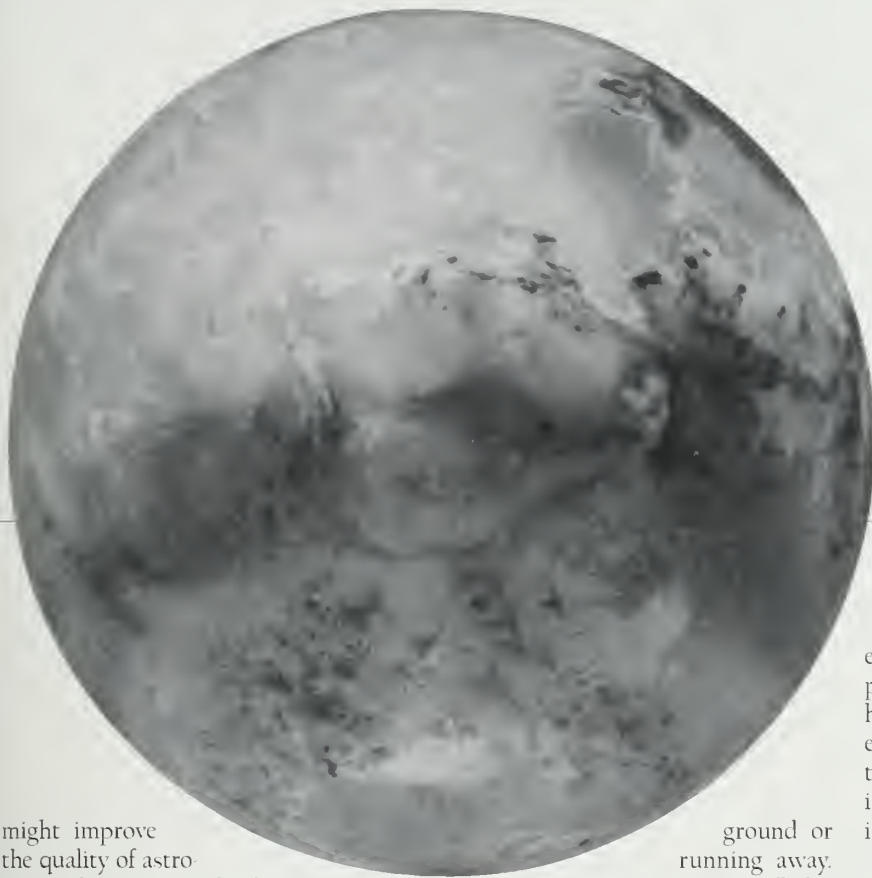
Boosted by the tremendous progress in understanding cell biology, Goldberg is now facing the challenge of developing rational therapies for muscle atrophy. Such solutions, he notes, should prove equally useful for those with muscle wasting on Earth. Even as NSBRI scientists begin to remove the medical obstacles to a trip to Mars and learn to prevent the deleterious effects of weightlessness—which would be exacerbated on such an extended mission—grounded Earthlings should also benefit from the research.

Nadia Rosenthal, associate professor of medicine at Massachusetts General Hospital and principal investigator on another NSBRI project, notes that any treatment of muscle atrophy, from gene therapy to drugs, will be relevant to prolonged bed-rest patients, the elderly, and even people wearing casts. "It's really the same research," she says, "so we can kill two birds with one stone if we're lucky."

One key bird, of course, is the one NASA hopes to see winging its way toward Mars. That achievement will require leaping an array of medical hurdles, primarily because of the sheer length of time Mars travelers will be in space. Travel time to Mars is six to ten months, and astronauts will spend an additional fifteen to twenty months on the red planet awaiting its next alignment with Earth.

Such an extended mission is likely to exacerbate not only muscle atrophy but also a variety of side effects, including bone loss and weakening of bone structure, "deconditioning" of the heart and circulatory system, chronic sleep deprivation, anemia, immunosuppression, and abnormal inflammatory responses. In addition, those venturing to Mars may experience radiation exposure and neurovestibular problems, such as the disruption of spatial orientation and posture control systems.

The objective of each of NSBRI's eight research teams is to gain an understanding of the relevant physiological mechanisms and to develop countermeasures. If the sleep hormone supplement melatonin pans out, for example, it



THE RED PLANET: A trip to Mars may take several years—six to ten months each way, with an additional fifteen to twenty months waiting for realignment with Earth.

might improve the quality of astronauts' sleep. Yet much of the relevant research at HMS is still in the basic science stage. "I'm not working on a piece of John Glenn's calf muscle," jokes Rosenthal. "That's not necessary at this point. But eventually, that's where the connection will be."

Some countermeasures, of course, have long been under investigation. To combat muscle wasting, for instance, the Russian space program, and later NASA, developed exercise protocols. Yet with their concentration on aerobic exercise to the near exclusion of isometric muscle use—which is much more difficult to achieve in weightless conditions—such regimes have had limited success.

Moreover, on Earth, notes Paul Huang, associate professor of medicine at Massachusetts General Hospital, "temporary incapacitation is fine—astronauts can be carried out of their spacecraft. But if they land somewhere hostile and have to respond quickly—to walk or even run—they'd be in trouble."

Huang's research—both with the NSBRI Cardiovascular Alterations Team and with a Johnson Space Center team—focuses on another side effect of reduced gravity that might keep Marslanders from either standing their

ground or running away. During a space flight,

explains Huang, fluid that normally pools in leg tissues enters the overall circulation, diluting the blood and increasing the circulating blood volume. The body reacts by urinating out the fluid, resulting in less total fluid in the body. When astronauts land, some have extremely low blood pressure and require a few days to return to normal; as with muscle loss, this problem would be exacerbated by extended flight times.

As part of their current research, the Johnson Space Center researchers took blood pressure measurements after John Glenn's Discovery mission landed last November, as well as after the landing of the space shuttle Endeavor. Because the research aims for a broad understanding of the mechanisms that regulate blood pressure and volume, its findings will have applications to fainting, syncope, and blood pressure problems.

Others who might benefit from space-based medical research include those suffering from stroke or Alzheimer's disease—both disorders of the hippocampus. Kenneth Kosik, director of cellular neurobiology at Brigham and Women's Hospital, stresses the spatial aspect of memory loss in people with

Alzheimer's. Although there may be earlier signs of trouble, he notes, many people don't seek medical help until they have been frightened by sudden and extreme disorientation. Spatial perception also is adversely affected by changes in gravity, which causes disorientation in jet pilots as well as astronauts.

But because studying a piece of John Glenn's hippocampus would prove even more problematic than examining a piece of his calf muscle, researchers are experimenting with rats. Along for the ride on the Neurolab mission in 1998 was a cage full of newborn rats. Kosik was involved in designing and conducting the experiment, which aimed to determine whether the removal of spatial cues during the development of the hippocampus might lead to permanent impairments, just as depriving children of visual stimuli during a critical period of brain development results in blindness. According to astronaut Richard Linnehan, the rat pups had a hard time learning to walk in space: "They moved much like we did—they used their forepaws, and when they came back to Earth they had to catch up."

Preliminary findings suggest that the rats are indeed catching up and now "seem pretty normal," says Kosik, who finds the very fact of the funding of this research encouraging. "This really does clear the way for a lot more research in space"—research, he says, that will help neurologists learn more about the complexities of brain development. ■

Debra Malina is a freelance writer based in Cambridge, Massachusetts.

Magical Stones &

From x-rays of the czar's and czarina's hands to Thomas Jefferson's ruminations on vaccines, *Magical Stones and Imperial Bones*—a new exhibit at the Countway Library of Medicine—



showcases the library's medical history collection. The exhibit reflects six centuries of medicine, from ancient treatises on the healing value of jewels to an early sample of the penicillin mold.

Imperial Bones



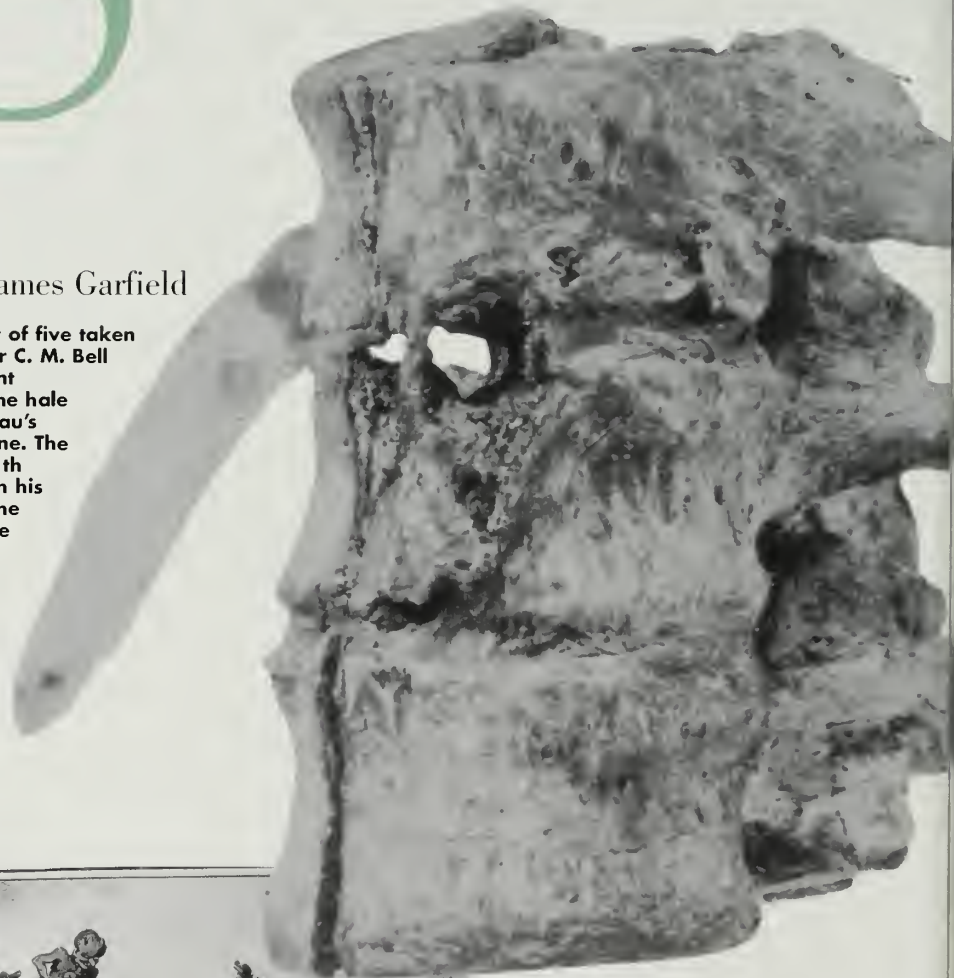
X-rays of the Hands of Nicholas II and Alexandra, Emperor and Empress of Russia

Taken in 1898, these photographic prints are not only some of the earliest x-ray images, but are also particularly notable for the clarity of the imperial couple's bones and jewelry. While the diagnostic value of W. K. Röntgen's discovery several years earlier had been immediately apparent to physicians, this technology also entertained the public—even the royal public—with its novelty. At the czar's request, Dr. H. H. Horne had brought his x-ray apparatus to the Winter Palace at St. Petersburg. During the photographic session, according to the doctor's wife, the equipment overloaded the palace's electrical system, and she inadvertently bumped into the czar in the darkness.

Magical S tones & Imperial Bones

Vertebrae of President James Garfield

This photograph, part of a set of five taken by Washington photographer C. M. Bell after the autopsy on President Garfield's body in 1881, shows the hole that assassin Charles Julius Guiteau's bullet made in the president's spine. The bullet fractured the president's 11th and 12th ribs and passed through his vertebrae from the right side to the left. The autopsy revealed that the immediate cause of Garfield's death was a ruptured aneurysm in the splenic artery—damage caused by either the bullet or the surgical probes of the physicians trying to remove the bullet.



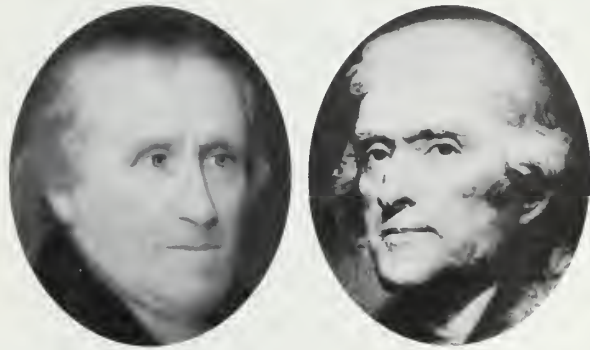
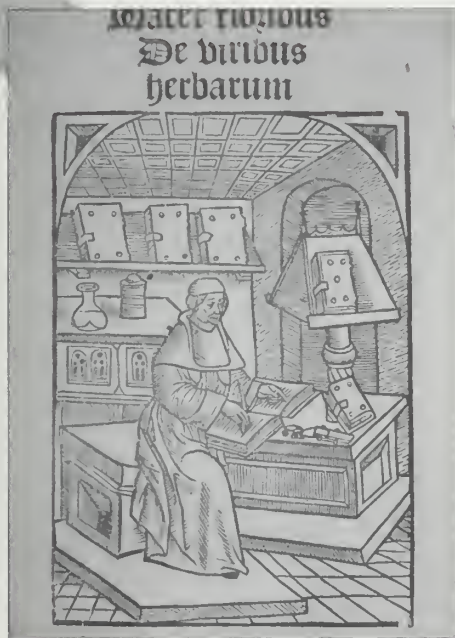
The Head ache

THE HEAD ACHE, BY GEORGE CRUIKSHANK

English artist and caricaturist George Cruikshank (1792–1878) was one of the foremost illustrators of the Regency and Victorian periods. He produced some 15,000 drawings and illustrated 850 books. Cruikshank's famous *Phrenological Illustrations* and his temperance tracts—*The Bottle* and *The Drunkard's Children*—are all in Count way Library's print collection. This less familiar engraving, which depicts an excruciating headache, forms part of a medical series showing the torments inflicted by the demons of colic, depression, jealousy, and indigestion.

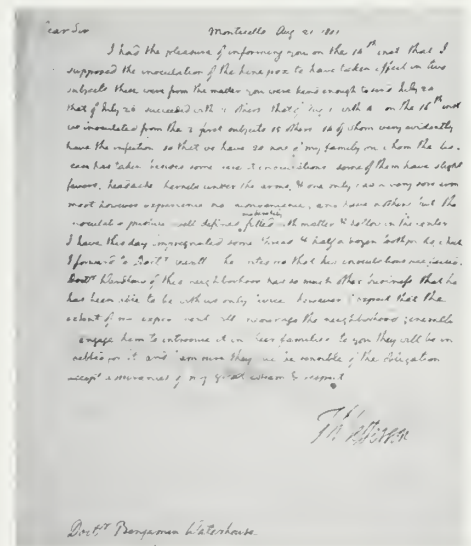
De Viribus Herbarum

Mocser's *De Viribus Herborum* ("On the powers of herbs") is one of the earliest surviving notural history texts from the Middle Ages. Nothing certain is known of "Mocser Floridus," but the name is believed to be a pseudonym of a twelfth-century French physician, Odo of Meung. *De Viribus*, a hexameter poem of more than 2,200 lines, delineates the medicinal virtues of common plants and herbs. It was a standard text in some of Europe's earliest medical schools. This edition, printed in Naples in 1477, is one of the first printed books.



LETTER FROM THOMAS JEFFERSON TO BENJAMIN WATERHOUSE

After successfully vaccinating his son against smallpox, Benjamin Waterhouse (1754–1846) sent a copy of his pamphlet *A Prospect of Exterminating the Small-Pox to* Thomas Jefferson, then vice president of the United States. Jefferson was keenly interested in Waterhouse's work, responding with, "Every friend of humanity must look with pleasure on this discovery, by which one more evil is withdrawn from the condition of man. In this line of proceeding you deserve well of your country." Waterhouse and Jefferson then corresponded on the subject for several months. As this letter from 1801 testifies, Jefferson used some vaccine matter from Waterhouse in experiments with members of his family and household staff at Monticello. Jefferson then promoted the use of the vaccine elsewhere in Virginia, gave some of his vaccine to Dr. John Redman Coxe to begin work in Philadelphia, and even sent samples with Lewis and Clark to encourage the use of vaccination throughout the country.



Penicillium Notatum

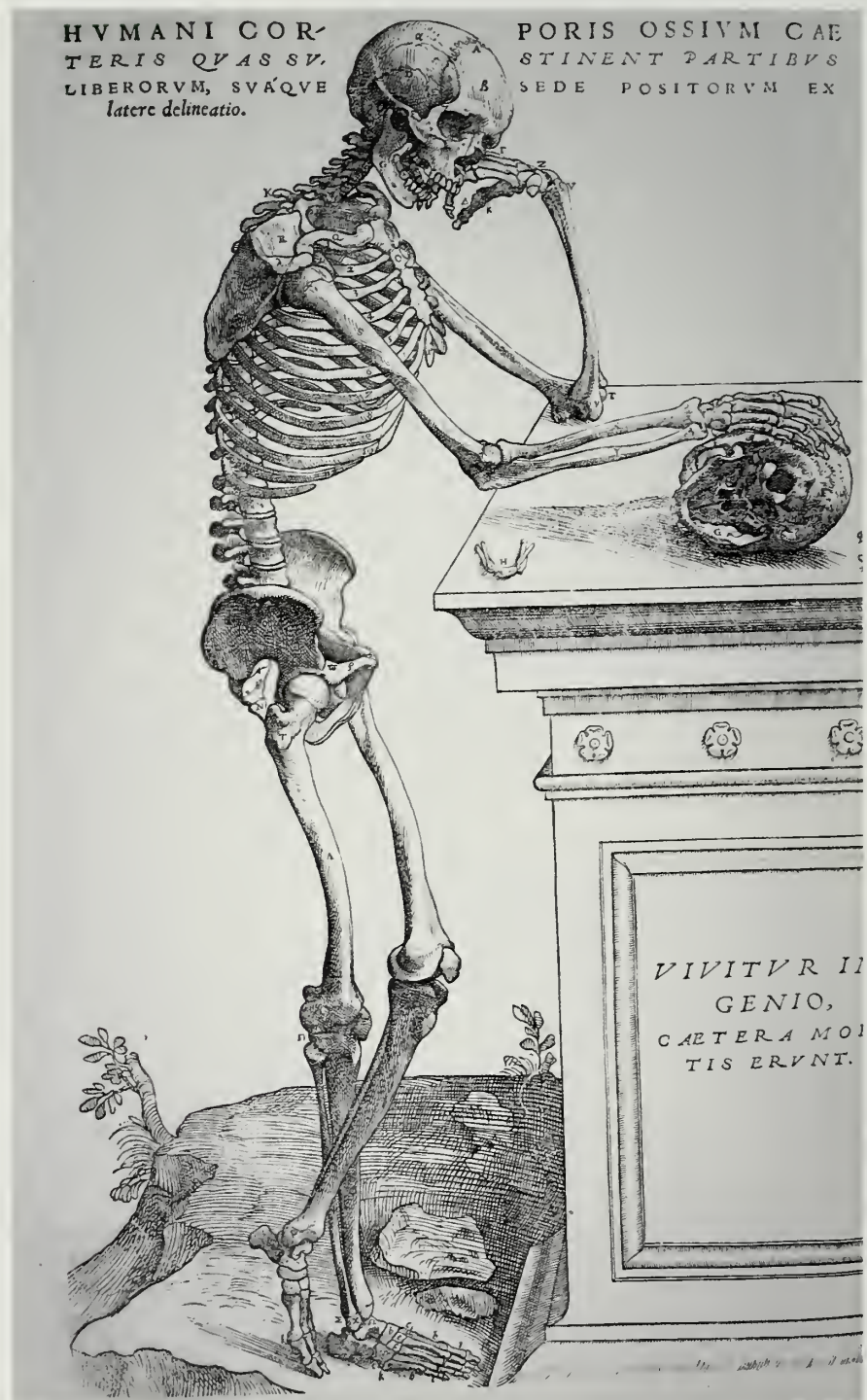
This cose contains a colony of *Penicillium notatum*—the mold from which penicillin is derived—which was grown in Alexander Fleming's laboratory around 1950. The British biochemist inadvertently discovered the antibacterial properties of the mold at St. Mary's Hospital in London in 1928, when he observed its ability to inhibit the growth of staphylococcus. Fleming later shared the Nobel prize with Howard Walter Florey and Ernst Boris Chain, who conducted the first clinical trials of penicillin in 1941. Infections from casualties during World War II prompted the efficient production of this landmark antibiotic and its transformation into the drug we know today.

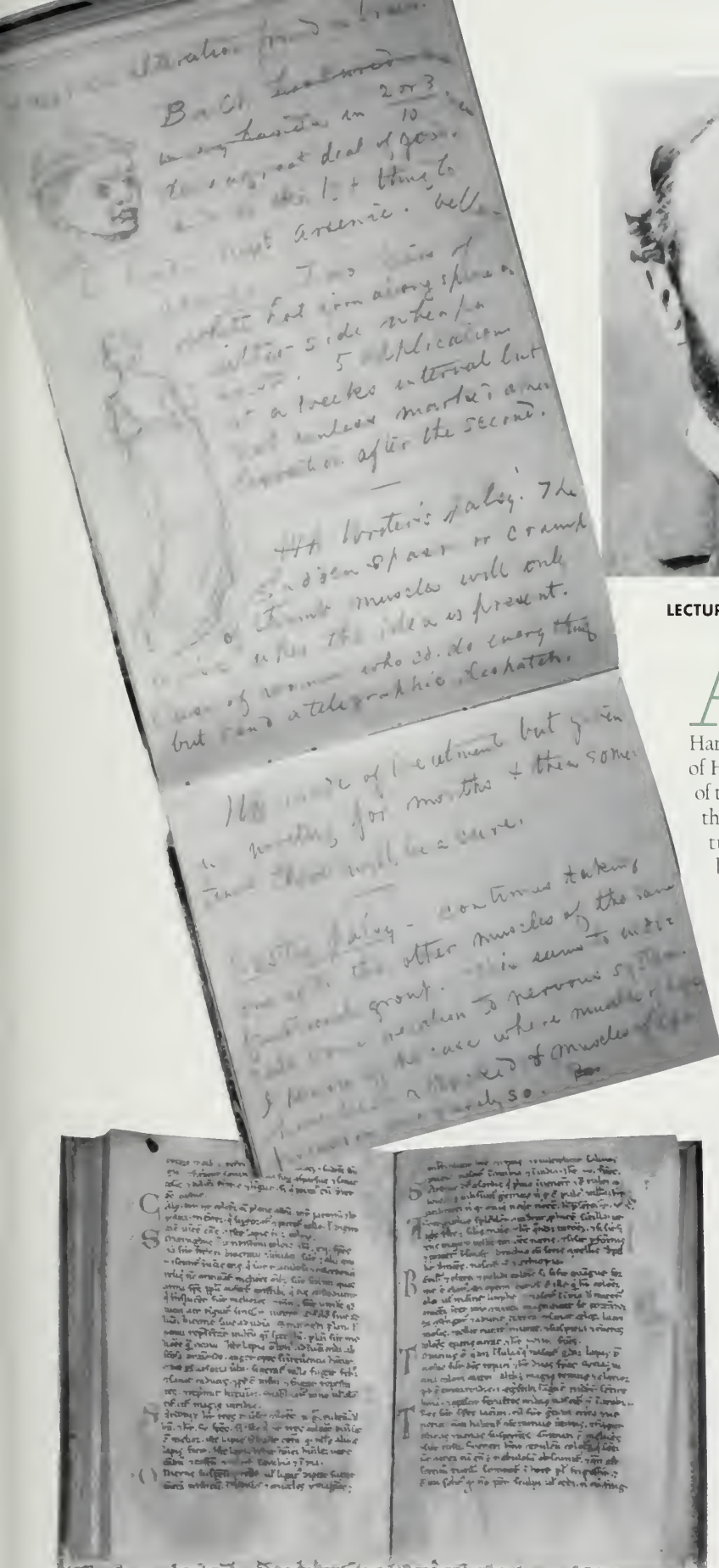


Magical Stones & Imperial Bones

DE HUMANI CORPORIS FABRICA

One of the most renowned and beautiful of all medical books, Vesalius's *De Humani Corporis Fabrica* ("On the artistry of the human body") revolutionized the teaching of anatomy. Andreas Vesalius (1514–1564), a Flemish anatomist, believed that the body could only properly be examined through dissection and promoted the study of human anatomy in a series of layers—from the bones of the skeleton, through the muscles, blood vessels, and nervous system, to the organs and, finally, the brain. The seven books of the *Fabrica* systematically examine this series of layers. This first edition of the *Fabrica* is one of four copies in the Countway Library collection. Prominent neurologist and historian Henry Rouse Viets (1890–1969) credited his first sight of this particular copy—opened by physician Harvey Cushing "as gently as an obstetrician with a newborn babe"—with inspiring his interest in the history of medicine.





LECTURE NOTES BY WILLIAM JAMES

Although he never practiced as a physician, philosopher and psychologist William James (1842–1910) graduated from HMS in 1869 and taught physiology during the 1870s. While at Harvard, James used this notebook to record the lectures of Henry Bigelow, Henry Bowditch, and other members of the medical faculty. In a letter to his sister, Alice, from this period, James claimed he had just attended a lecture at HMS “which I could not understand a word of, but rather enjoyed the sensation of listening to for an hour.” Here James—despite his wandering attention—has taken notes on Charles Edouard Brown-Séquard’s lectures on writer’s palsy and other diseases of the nervous system.

De Lapidibus

Bishop Marbade of Rennes (1035–1123) was a poet, teacher, and scholar. His best-known work, *De Lapidibus* (“On gemstones”), is a verse treatise describing the medicinal, therapeutic, and magical properties of 60 different jewels. The two leaves of this early-thirteenth-century edition describe the properties of chalcedany, emerald (smaragdus), sardanyx, onyx, sard, chrysalite, beryl, and tapaz. *De Lapidibus* was one of the most popular works of scientific and medical lore in the Middle Ages. More than 125 Latin manuscripts have survived, and translations into French, Spanish, Irish, Hebrew, and English are known. This *De Lapidibus* manuscript is one of only three in the United States.

The Doctor's Two-Step: From Operating Room to Ballroom

MERCEDES VON DECK '92 WALKS into the operating room of Somerville Hospital, scrubbed and ready. As the attendant turns on the Muzak, one can't help but wonder: Is she going to break into a little soft-shoe routine?

Not to worry, says the 37-year-old orthopedic surgeon, who resembles Ginger Rogers in her prime. When she has a patient under anesthesia and his hip opened up, she says, "I am so focused on my work that I have no trouble concentrating on surgery."

Dancing is for her off hours. Nearly all of them.

Von Deck is an orthopedic surgeon by day and a competitive ballroom dancer by night. Add about three hours of dance practice a day to eight-and-one-half hours of orthopedics practice, plus many a weekend traveling to dance competitions and every third night and many weekends on call for emergencies, and you have nearly all of her hours, save for sleep time, filled. A former professional dancer, she's had to return to amateur status due to the pressures of the O.R. Still, von Deck is always preparing for one or two competitions here or abroad.

She and her dancing partner, Mark Sheldon, a research scientist at Lotus Development Corporation, won the Heritage Championship in North Carolina in 1997, one of the few non-professional competitions to be televised. She says without boasting, "We're easily in the top ten in the country, maybe the top six."

You'll never hear von Deck complain about the pressures of

this dual role she has happily taken on. She forgoes dinner with her husband to practice dancing; she never leaves the office for lunch, so that she won't feel as guilty about leaving on time at the end of the day.

On the day of this surgery, a typical Tuesday, she has 17 patients waiting to see her, including a 12-year-old girl added to the roster because she'd broken both wrists over the weekend in a snowboarding accident.

The pressures around her don't seem to faze the quiet von Deck. "She's no prima donna," says Ro Sarro, the surgical suite nurse manager at the hospital.



I ONLY HAVE EYES FOR YOU: When she has a patient under anesthesia and his hip opened up, von Deck says, "I am so focused on my work that I have no trouble concentrating on surgery."

Von Deck's chief of orthopedics, Samuel Doppelt, says her energy is inspirational. "She's an enthusiastic doctor, a wonderful surgeon, and a team player," says Doppelt. "You have to have a lot of energy to do both orthopedics and dancing, but she seems to have it. I think it's wonderful to have extra-curricular activities; it adds a little dimension to your life."

Making it look easy, von Deck goes straight from her last patient at Somerville Hospital to a practice room at the Massachusetts Institute of Technology, nibbling on a dinner of sweet potato and a bagel she's packed in the car. There she meets Sheldon, who has brought with him a boombox with dance music discs, and another half of a blueberry bagel for her.

They like MIT because its dance club is known as one of the best in the area and it offers spaces to practicing dancers. The pair begins the dips and turns and double rondes of serious ballroom dancing, stopping only when they reach a wall to discuss changes in their patterns.

Von Deck is wearing the same delicate white crepe blouse she wore with pants earlier in the day. But now she has slipped on an ankle-length full skirt and high-heeled dancing shoes. For competitions, she wears much more dramatic gowns.

Von Deck and Sheldon always gather themselves into a beautifully postured dance position before they begin, and they talk constantly about position. "The impetus actually felt better that time, but my head felt wrong," says Sheldon, and then they try the same step again.

Von Deck is doing some complicated steps, such as the "standing spin," the kind of

maneuver you wouldn't dare attempt without plenty of flexibility and a great deal of practice with the same partner. Once, von Deck recalls, excessive practice caused some stress fractures in her feet. "But I just ignored them and they went away," she says casually.

For the next several hours, as MIT students wander by—"Oh, what fun!" one exclaims—von Deck and Sheldon practice their waltzes, foxtrots, and quicksteps. Then she goes home to Newton and her husband, cardiac surgeon Robert Bojar. Or she and Bojar might meet for a second, 8:00 p.m. dance class before she has a quick snack and falls into bed around 10:00.

Dancing is not far from her mind even at the hospital. Earlier in the day, as she made incisions in the knee of a patient, one of the O.R. nurses asked about a previous week off, when she and Sheldon had gone to England for intensive coaching.

As she continued probing the knee, Von Deck told the nurse that the week had been great. "All the professional world champions seem to be from England," she says, "and so we go there for training."

In Boston, von Deck and Sheldon are coached weekly by a professional teacher, and every other week they take lessons from another international competitor at a local Fred Astaire Dance Studio.

Von Deck, an Iowa native reared in Hopkinton, took dancing lessons as a child, but most of her attention was turned toward academics. As an undergraduate, she majored in art history at Washington University in St. Louis, and then she enrolled in HMS in 1984. That summer, she began taking lessons at the MIT dance club; it was her first flirtation with ballroom dancing, and she was hooked.

"Dancing was the only thing I did besides study," she recalls, "and it was so different and a nice change from everything else I was doing."

Von Deck and her partner at the time began competing, and they did so well that after her second year of medical school, von Deck decided to take a two-and-a-half year leave of absence. Her success continued, she turned professional, and the leave extended to four years, although she continued to do research in bone metabolism at Children's Hospital in Boston and Massachusetts General Hospital.

Finally, though, "dancing did not seem to be enough," so she headed back to school. Her original plan, she says, was to specialize in internal medicine, but she fell in love with surgery during a clinical rotation. And because of her interest in dancing she chose orthopedic surgery as a specialty.

"I like the hands-on work of surgery and the results," she says. "The nice thing about it is that something is wrong, and you fix it." In 1997, she completed her training for the specialty, which included one year of internship and four years of residency. A year later, she and Sheldon were honored as the United States Dance Sport Amateur Standard Couple of the Year.

Von Deck met her husband during her residency, and soon after their wedding in 1996, he started taking dancing lessons. She is too advanced to be his partner in competitions in the standard ballroom dances, but they do compete as partners in sambas, chachas, and rumbas.

Much of von Deck's vacation time is spent in competition. She says her husband is "understanding, and supportive, and very competitive—he wants me to win."



I COULD HAVE DANCED ALL NIGHT: "Dancing was the only thing I did besides study," von Deck recalls, "and it was so different and a nice change from everything else I was doing."

After winning the Harvard Invitational Ballroom Dance Competition in February, when she was four months pregnant, von Deck took a short break from competitive dancing to give birth to a baby girl, Alana, in July. Soon after, she and her partner made the finals in the United States Open Amateur Standard Championships and were chosen to represent the United States in the Over 35 World Championships to be held in September in New Zealand. "Not bad for five weeks postpartum," she says. ■

Julie Hatfield is the "Partylines" columnist at the Boston Globe.

Reprinted and updated courtesy of the Boston Globe

Harvard Medical Alumni Association

25 Shattuck Street
Boston, Massachusetts 02115
Change Service Requested

Non-Profit Organization

U.S. Postage PAID
Permit No. 52420
Boston, MA